

EAST AFRICAN HEALTH RESEARCH COMMISSION
Research for Health and Prosperity

BOOK OF ABSTRACTS

SEVERE ACUTE RESPIRATORY SYNDROME IN EAST AFRICA 2021





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SEVERE ACUTE RESPIRATORY SYNDROME

EAST AFRICAN HEALTH RESEARCH COMMISSION

2021

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INTRODUCTION

Severe Acute Respiratory Syndrome (SARS) is a viral respiratory disease caused by a SARS-associated coronavirus. It was first identified at the end of February 2003 during an outbreak that emerged in China and spread to four (4) other countries. SARS is an airborne virus and can spread through small droplets of saliva in a similar way to the cold and influenza. SARS can also be spread indirectly via surfaces that have been touched by someone who is infected with the virus.

Coronavirus Disease 2019 (COVID-19) is an infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). The first confirmed case of what was then an unknown Coronavirus was tracked back to November 2019 in Hubei province of the People's Republic of China. On 07th January 2020, the causative agent was identified to be a novel coronavirus (2019-nCoV), currently referred to as the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). On 30th January 2020, the World Health Organization (WHO) declared COVID-19 as the sixth public health emergency of international concern. Subsequently, on 11th March 2020, the WHO declared the COVID-19 outbreak as a global pandemic.

The first case of COVID-19 in the East Africa Community (EAC) Partner States was officially announced in March 2020. The pandemic prompted the EAC to develop the EAC Regional COVID-19 Response Plan. The response plan was officially launched on the 30th April 2020 at the EAC Headquarters in Arusha City of Tanzania. The response plan directs the EAC Partner States and other stakeholders to conduct regional research to guide policy and practice in order to reinforce measures to protect and prevent further spread of the novel coronavirus pandemic within the region. The response plan was developed following a directive by the Joint Meeting of Ministers responsible for Health, Trade and EAC Affairs.

Currently, all the six (6) Partner States of the EAC are continuing to implement various response measures and initiatives to mitigate the severe and long-term impacts of the pandemic, including the on-going public mass COVID-19 vaccinations in each Partner State in order to achieve a critical level of the adult population vaccinated and thus ensure herd immunity and protection from further infections and prevent occurrence of severe infections and attendant severe complications and/or disability and death from COVID-19.

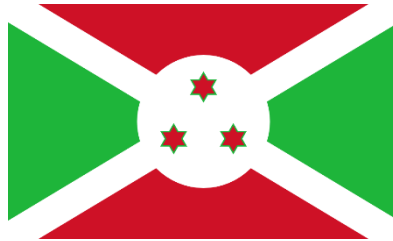
Together with evidence from current research that will be presented by experts during the 8th East African Health and Scientific Conference to be held from 17th to 19th November 2021, the book of abstracts will serve as an excellent resource to support discussion during the symposium dedicated to COVID-19 pandemic in EAC region and strategies put in place to address the pandemic. The symposium is part of the conferences and aims to provide recommendations and strategies for the implementations of the EAC COVID-19 response plan. This will be one of the initiatives to address this growing global COVID-19 pandemic.

I wish you a fruitful reading and discussions.

Dr Novat Twangubumwe, MD, MSc
Acting Executive Secretary
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East African Community

12 citations
(Sorted by Partner State)

Burundi



1. The East African Community (EAC) mobile laboratory networks in Kenya, Burundi, Tanzania, Rwanda, Uganda, and South Sudan-from project implementation to outbreak response against Dengue, Ebola, COVID-19, and epidemic-prone diseases

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ABSTRACT

BACKGROUND: East Africa is home to 170 million people and prone to frequent outbreaks of viral hemorrhagic fevers and various bacterial diseases. A major challenge is that epidemics mostly happen in remote areas, where infrastructure for Biosecurity Level (BSL) 3/4 laboratory capacity is not available. As samples have to be transported from the outbreak area to the National Public Health Laboratories (NPHL) in the capitals or even flown to international reference centres, diagnosis is significantly delayed and epidemics emerge

MAINTEXT: The East African Community (EAC), an intergovernmental body of Burundi, Rwanda, Tanzania, Kenya, Uganda, and South Sudan, received 10 million € funding from the German Development Bank (KfW) to establish BSL3/4 capacity in the region. Between 2017 and 2020, the EAC in collaboration with the Bernhard-Nocht-Institute for Tropical Medicine (Germany) and the Partner Countries' Ministries of Health and their respective NPHLs, established a regional network of nine mobile BSL3/4 laboratories. These rapidly deployable laboratories allowed the region to reduce sample turn-around-time (from days to an average of 8h) at the centre of the outbreak and rapidly respond to epidemics. In the present article, the approach for implementing such a regional project is outlined and five major aspects (including recommendations) are described: (i) the overall project coordination activities through the EAC Secretariat and the Partner States, (ii) procurement of equipment, (iii) the established laboratory setup and diagnostic panels, (iv) regional training activities and capacity building of various stakeholders and (v) completed and ongoing field missions. The latter includes an EAC/WHO field simulation exercise that was conducted on the border between Tanzania and Kenya in June 2019, the support in molecular diagnosis during the Tanzanian Dengue outbreak in 2019, the participation in the Ugandan National Ebola response activities in Kisoro district along the Uganda/DRC border in Oct/Nov 2019 and the deployments of the laboratories to assist in SARS-CoV-2 diagnostics throughout the region since early 2020

CONCLUSIONS: The established EAC mobile laboratory network allows accurate and timely diagnosis of BSL3/4 pathogens in all East African countries, important for individual patient management and to effectively contain the spread of epidemic-prone diseases.

Keywords: BSL4; COVID-19; Capacity building; Dengue fever; East African Community; Ebola virus disease; Mobile laboratory; Outbreak response; Viral haemorrhagic fevers

2. Commentary: mobile laboratories for SARS-CoV-2 diagnostics: what Europe could learn from the East African Community to assure trade in times of border closures?

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ABSTRACT

BACKGROUND: The emergence of SARS-CoV-2 mutants might lead to European border closures, which impact on trade and result in serious economic losses. In April 2020, similar border closures were observed during the first SARS-CoV-2 wave in East Africa.

MAIN BODY: Since 2017 the East African Community EAC together with the Bernhard-Nocht-Institute for Tropical Medicine BNITM established a mobile laboratory network integrated into the National Public Health Laboratories of the six Partner States for molecular diagnosis of viral hemorrhagic fevers and SARS-CoV-2. Since May 2020, the National Public Health Laboratories of Kenya, Rwanda, Burundi, Uganda and South Sudan deployed these mobile laboratories to their respective borders, issuing a newly developed “Electronic EAC COVID-19 Digital Certificate” to SARS-CoV-2 PCR-negative truck drivers, thus assuring regional trade.

CONCLUSION: Considering the large financial damages of border closures, such a mobile laboratory network as demonstrated in East Africa is cost-effective, easy to implement and feasible. The East African Community mobile laboratory network could serve as a blueprint for Europe and other countries around the globe.

Keywords: SARS-CoV-2 diagnostics, COVID-19, Pandemic, Border closures, Mobile laboratories, BSL4, East Africa, EAC, Electronic health certificate, Trade

3. Cholelithiasis and cholecystitis following Sars-Cov-2 infection. A case Report

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ABSTRACT

Our goal was to contribute to the understanding of the obstructive jaundice pathogenesis during SARS-CoV-2 recovering period. This was a 51-year-old patient with no particular medical history recovering from SARS-CoV-2 infection. He was recently discovered diabetic when diagnosed with SARS-CoV-2 infection. He underwent surgery for cholelithiasis and cholecystitis. The pancreatic biopsies and histological analysis were also performed. The histological analysis revealed lesions of acute pancreatitis. The early post-surgical follow-up was good. The follow-up CT-scan performed after two weeks of surgery showed an overall normal pancreas.

Key words: obstructive jaundice; SARS-CoV-2; surgery

4. Understanding the influence of the COVID-19 pandemic on hospital-based mortality in Burundi: a cross-sectional study comparing two time periods

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ABSTRACT

This study used hospital records from two time periods to understand the implication of COVID-19 on hospital-based deaths in Burundi. The place of COVID-19 symptoms was sought among deaths that occurred from January to May 2020 (during the pandemic) vs. January to May 2019 (before the pandemic). First, death proportions were tested to seize differences between mortality rates for each month in 2020 vs. 2019. In the second time, we compared mean time-to-death between the two periods using the Kaplan–Meier survival curve. Finally, a logistic regression was fitted to assess the likelihood of dying from COVID-19 symptoms between the two periods. We found statistical evidence of a higher death rate in May 2020 as compared to May 2019. Moreover, death occurred faster in 2020 (mean = 6.7 days, s.d. = 8.9) than in 2019 (mean = 7.8 days, s.d. = 10.9). Unlike in 2019, being a male was significantly associated with a much lower likelihood of dying with one or more COVID-19 symptom(s) in 2020 (odds ratio 0.35, 95% confidence interval 0.14–0.87). This study yielded some evidence for a possible COVID-19-related hospital-based mortality trend for May 2020. However, considering the time-constraint of the study, further similar studies over a longer period of time need to be conducted to trace a clearer picture on COVID-19 implication on hospital-based deaths in Burundi.

Key words: Burundi, COVID-19, hospital-based deaths, tertiary hospital

5. Mapping physical access to health care for older adults in sub-Saharan Africa and implications for the COVID-19 response: a cross-sectional analysis

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ABSTRACT

BACKGROUND: Severe acute respiratory syndrome coronavirus 2, the virus causing COVID-19, is rapidly spreading across sub-Saharan Africa. Hospital-based care for COVID-19 is often needed, particularly among older adults. However, a key barrier to accessing hospital care in sub-Saharan Africa is travel time to the nearest health-care facility. To inform the geographical targeting of additional health-care resources, we aimed to estimate travel time at a 1 km × 1 km resolution to the nearest hospital and to the nearest health-care facility of any type for adults aged 60 years and older in sub-Saharan Africa.

METHODS: We assembled a dataset on the geolocation of health-care facilities, separately for hospitals and any type of health-care facility and including both private-sector and public-sector facilities, using data from the OpenStreetMap project and the Kenya Medical Research Institute–Wellcome Trust Programme. Population data at a 1 km × 1 km resolution were obtained from WorldPop. We estimated travel time to the nearest health-care facility for each 1 km × 1 km grid using a cost-distance algorithm.

FINDINGS: 9·6% (95% CI 5·2–16·9) of adults aged 60 years or older across sub-Saharan Africa had an estimated travel time to the nearest hospital of 6 h or longer, varying from 0·0% (0·0–3·7) in Burundi and The Gambia to 40·9% (31·8–50·7) in Sudan. For the nearest health-care facility of any type (whether primary, secondary, or tertiary care), 15·9% (95% CI 10·1–24·4) of adults aged 60 years or older across sub-Saharan Africa had an estimated travel time of 2 h or longer, ranging from 0·4% (0·0–4·4) in Burundi to 59·4% (50·1–69·0) in Sudan. Most countries in sub-Saharan Africa contained populated areas in which adults aged 60 years and older had a travel time to the nearest hospital of 12 h or longer and to the nearest health-care facility of any type of 6 h or longer. The median travel time to the nearest hospital for the fifth of adults aged 60 years or older with the longest travel times was 348 min (IQR 240–576; equal to 5·8 h) for the entire population of sub-Saharan Africa, ranging from 41 min (34–54) in Burundi to 1655 min (1065–2440; equal to 27·6 h) in Gabon.

INTERPRETATION: Our high-resolution maps of estimated travel times to both hospitals and health-care facilities of any type can be used by policy makers and non-governmental

organizations to help target additional health-care resources, such as makeshift hospitals or transport programmes to existing health-care facilities, to older adults with the least physical access to care. In addition, this analysis shows the locations of population groups most likely to under-report COVID-19 symptoms because of low physical access to health-care facilities. Beyond the COVID-19 response, this study can inform the efforts of countries to improve physical access to care for conditions that are common among older adults in the region, such as chronic non-communicable diseases.

6. The spatio-temporal epidemic dynamics of COVID-19 outbreak in Africa

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ABSTRACT

Corona virus disease 2019 (COVID-19), caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was first detected in the city of Wuhan, China in December 2019. Although, the disease appeared in Africa later than other regions, it has now spread to virtually all countries on the continent. We provide early spatio-temporal dynamics of COVID-19 within the first 62 days of the disease's appearance on the African continent. We used a two-parameter hurdle Poisson model to simultaneously analyze the zero counts and the frequency of occurrence. We investigate the effects of important healthcare capacities including hospital beds and number of medical doctors in different countries. The results show that cases of the pandemic vary geographically across Africa with notably high incidence in neighboring countries particularly in West and North Africa. The burden of the disease (per 100 000) mostly impacted Djibouti, Tunisia, Morocco and Algeria. Temporally, during the first 4 weeks, the burden was highest in Senegal, Egypt and Mauritania, but by mid-April it shifted to Somalia, Chad, Guinea, Tanzania, Gabon, Sudan and Zimbabwe. Currently, Namibia, Angola, South Sudan, Burundi and Uganda have the least burden. These findings could be useful in guiding epidemiological interventions and the allocation of scarce resources based on heterogeneity of the disease patterns.

Keywords: Africa; Bayesian analysis; COVID-19; hurdle Poisson; spatial analysis.

7. COVID-19 and Measles: Double Trouble for Burundi

Sanjeet Bagcchi

Lancet Microbe. 2020 Jun; 1(2): e65.

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Author' information:

Sanjeet Bagcchi is a private medical practitioner with extensive writing experience.

ABSTRACT

As of May 19, 2020, Burundi has reported 42 cases of COVID-19 and one death from the disease, compared with 63 521 cases and 1796 deaths reported across Africa by WHO. Burundi had its presidential election on May 20, and before the election, the foreign ministry asked WHO representatives who had reportedly expressed concerns over crowded rallies held by politicians to leave the country, with no explanation provided. Media reports claim that authorities in Burundi have underestimated the risks of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and relied on divine protection, instead of adopting specific health measures to contain the pandemic. However, while Burundi's preparedness and response to SARS-CoV-2 sparks controversy, the country's management of an already ongoing measles outbreak has caused concern among virologists, pediatricians, and public health experts. A WHO statement released on May 6, 2020, reports the measles outbreak started November, 2019, with 857 confirmed cases from Burundi's districts Cibitoke, Butezi, Cankuzo and South Bujumbura, as of April 27, 2020. The outbreak began in a refugee transit camp in the Cibitoke health district, where refugees from measles-affected provinces in DR Congo remained for 21 days, before moving to permanent refugee camps in locations including Butezi, Cankuzo, Muyinga, and Kiremba. The outbreak was only recognized when people living in areas surrounding the refugee transit camp reported suspected measles cases, mainly in children aged 9 months to 5 years. WHO's report states: "Measles circulation in a population with low immunity is the cause of this outbreak. The majority of cases (77%) were either unvaccinated or unsure of their vaccination status". Oyewale Tomori, a professor of virology and former president of the Nigerian Academy of Science agrees with this explanation. "This [measles] outbreak predates the COVID-19 outbreak either in Wuhan or in any part of Africa. It is clear that unvaccinated or inadequately vaccinated refugee children are the source of the outbreak in a poorly vaccinated Burundi population", he told *The Lancet Microbe*. He added, "It is obvious that there is also a lack of preparedness [in Burundi] to fight the measles outbreak". According to Andrew Noymer, an associate professor of Public Health at the University of California, Irvine (CA, USA), an outbreak of measles is unsurprising where vaccination rates have fallen below about 95%. WHO's statement estimates the vaccination coverage for measles in Burundi, in 2018, to be 88% for the first dose and 77% for the second dose, although these

figures do not include data for incoming refugees. “This measles outbreak [in Burundi] is a stark reminder that even during the COVID-19 pandemic public health challenges that existed before, have not gone away”, Noymer told *The Lancet Microbe*. As he pointed out, measles control requires continued vaccination programmes, catch-up campaigns, or both. “[It’s] a challenging disease, requiring constant attention from public health authorities”, he comments. Charles Holmes (Center for Global Health Practice and Impact, Georgetown University Medical Center, Georgetown, WA, USA) told *The Lancet Microbe* that the estimated case-fatality rate for measles in low-income and middle-income countries is approximately 2%. In Burundi, he notes, the mortality rate for measles would probably be much higher “because of high rates of malnourishment, vitamin A deficiency, and HIV/AIDS all of which increase the risk of severe complications from measles”. With respect to COVID-19, Holmes believes that, for Burundian children, the risk of severe disease and death from measles is far higher. “And unlike with COVID-19, we have an affordable, effective vaccine [for measles] that could prevent these deaths”, he added. Anish Ray, a pediatrician at the Cook Children’s Medical Center (Fort Worth, TX, USA) agrees with the views of Holmes. “COVID-19 and measles both are communicable diseases, but measles has a safe and effective vaccine, and there is no vaccine against COVID-19, yet. Burundian children now require proper vaccination coverage for measles and a thoroughly planned approach designed by the country’s health authorities, WHO, and other organizations to tackle the current outbreak”, he told *The Lancet Microbe*. According to WHO’s report, Burundi’s Ministry of Public Health in partnership with international organizations including WHO, UNICEF, and Médecins Sans Frontières has devised a comprehensive response plan to the measles outbreak, including the formation a technical committee to monitor its implementation. The plan also includes vaccinating children aged 9 months to 14 years at refugee camps, setting up a vaccination post at the refugee transit camp, strengthening surveillance at affected districts, mobilizing financial resources, building health-care provider capacity, and actively searching and vaccinating unvaccinated children. As Noymer points out, the measles epidemic is an indication that a vaccination campaign is required in the most affected provinces and, possibly, nation-wide in Burundi. “The COVID-19 pandemic is serious but neglecting other fatal health conditions during this time would be a mistake”, he points out.

8. COVID-19 pandemic: Review of impediments to public health measures in Sub-Saharan Africa

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10.5455/ajpmph.20200512020014 review article Open Access

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ABSTRACT

The first coronavirus disease 2019 (COVID-19) case in Sub-Saharan Africa was reported in Nigeria on 27th February 2020, and within weeks the disease spread to all African countries, except Lesotho as of 1st May 2020. In this review, we have evaluated the public health measures initiated in sub-Saharan African countries to mitigate the spread of COVID-19, highlighted the impediments to these measures, and provided recommendations. We reviewed the strategies

initiated in Nigeria, South Africa, Rwanda, and Burundi. It was found that the governments of these countries initiated several measures, including hand and respiratory hygiene, maintaining a distance from other people, quarantining travelers, and isolating symptomatic cases. Moreover, the lockdown was instituted to further reduce the spread of COVID-19 in Nigeria, South Africa, and Rwanda, while in Burundi there was no lockdown.

However, the fragile medical infrastructure, poor living conditions, lack of social welfare system, draconian lockdown implementation strategies, and inconsistent information from authorities have impeded the success. The lockdown and social distancing measures have not reduced the rate of infection in these countries, and the implementation of the measures was sporadic and not backed up with increased capacities of diagnostic tests. It is strongly recommended that sub-Saharan African countries increase testing and follow scientific evidence in cautiously easing the lockdown, and develop postpandemic plans to revitalize the medical and socioeconomic infrastructure. In conclusion, the governments of these countries should look inward for solutions to their problems and avoid implementing western anti-COVID-19 policies without consideration of the peculiarities in African societies

Keywords: COVID-19; sub-Saharan; Africa; public health; lockdown; impediments

9. Circulation of different rhinovirus groups among children with lower respiratory tract infection in Kiremba, Burundi

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ABSTRACT

The purpose of this investigation was to collect information regarding rhinovirus (RV) circulation in children with lower respiratory tract infections (LRTIs) in Burundi, Central Africa. We enrolled all of the children aged between 1 month and 14 years who were admitted to the hospital of Kiremba, North Burundi, with fever and signs and symptoms of LRTI (i.e., cough, tachypnea, dyspnea or respiratory distress, and breathing with grunting or wheezing sounds with rales) between 1 November 2010 and 31 October 2011, and obtained nasopharyngeal swabs for RV detection by means of polymerase chain reaction (PCR). The VP4/VP2 region of the positive samples was sequenced to determine the species of RV (A, B, or C). Four hundred and sixty-two children were enrolled: 160 (34.6 %) with bronchitis, 35 (7.6 %) with infectious wheezing, and 267 (57.8 %) with community-acquired pneumonia (CAP). RV infection was demonstrated in 186 patients [40.3 %; mean age \pm standard deviation (SD) 1.77 \pm 2.14 years]. RV infection was detected in 78 patients aged <12 months (40.0 %), 102 aged 12–48 months (44.3 %), and six aged >48 months (16.7 %; $p < 0.01$ vs. the other age groups). The most frequently identified RV was RV-A (81 cases, 43.5 %), followed by RV-C (47, 25.3 %) and RV-B (18, 9.7 %); subtyping was not possible in 40 cases (21.5 %). RV-A was significantly associated with bronchitis and CAP ($p < 0.01$) and RV-C with wheezing ($p < 0.05$). In Burundi, RVs are frequently detected in children with LRTIs. RV-A seems to be the most important species and is identified mainly in patients with bronchitis and CAP

Key words: Burundi, respiratory diseases, children

10. Middle ear problems in children hospitalized because of lower respiratory tract infections: A comparison between two cohorts in Burundi and Italy

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ABSTRACT

OBJECTIVES: To compare the prevalence of acute otitis media (AOM) and otitis media with effusion (OME) in children hospitalized for acute lower respiratory infections (LRTIs) in Burundi and Italy.

METHODS: The study, which was conducted from 1 February to 30 April 2011 at the hospital of Kiremba (Burundi, Africa) and at Paediatric Clinic 1 of the University of Milan (Italy), enrolled patients aged <5 years who were hospitalized because of LRTIs. Upon admission, the children underwent an otological examination (pneumatic otoscopy and tympanometry), and middle ear diseases were compared between the two groups.

RESULTS: A total of 108 children enrolled in Burundi (44 males; median age 17 months) were compared to 108 patients enrolled in Italy (53 males; median age 19 months). About one-third of the children in Burundi (33, 30.6%) had normal middle ears. AOM was never diagnosed, whereas OME was detected in 74 children (68.5%: bilateral in 51, 68.9%, and unilateral in 23, 31.1%). The prevalence of OME decreased with increasing age: it was 86.5% in children aged <12 months, 73.7% in those aged 12–24 months, and 43.8% in those aged >24 months ($p < 0.001$). There was no difference in the proportion of children with OME in Burundi (68.5%) and Italy (63.9%; $p = 0.47$). OME was significantly more frequent in the children with pneumonia admitted in Burundi than in the children with pneumonia admitted in Italy ($p = 0.004$).

CONCLUSIONS: In children hospitalized for lower respiratory tract infection, OME is almost as frequently seen in developing countries like Burundi, Africa, as in developed countries like Italy. Follow-up monitoring of these children might be required to assess if OME is just a transient phenomenon.

Keywords: Otitis media with effusion, Children, Developing countries, Middle ear diseases, Acute otitis media, Lower respiratory tract infections.

11. Burundi: knowledge and practices of physicians and nursing personnel about acute respiratory infections in children

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ABSTRACT

In order to detect problems in the management of acute respiratory infection in children and to optimize training, a survey was undertaken in 1993 including 9 pediatricians, 27 general practitioners, and 58 nurses in Bujumbura, Burundi. A questionnaire including 15 main items was used. Findings showed a poor understanding of risk factors in 62% of the population, especially among general practitioners and nurses. Clinically 79% were able to make a proper diagnosis of pneumonia. Overtreatment of coryza using antimicrobial, mucolytic, and cough drugs was suspected in 88.8%. Findings were similar with regard to management of pneumonia. Wheezing was treated in accordance with WHO recommendations in only 18% of cases. For acute respiratory infection, 53.6% used penicillin A, 18% used penicillin G, 15.9% used cotrimoxazole and 2.9% used macrolides. The duration of antimicrobial therapy was unnecessarily long for 49.4%. While 70.5% of the population (100% of pediatricians) considered the state of their knowledge and practices to be sufficient, 93.6% (55.6% of pediatricians) indicated that specific training in this field would be useful. This survey suggests that training is needed for health care workers at all levels specifically in the management and prevention of acute respiratory infection in children

12. Pulmonary Complications of Human Immunodeficiency Virus Infection in Bujumbura, Burundi

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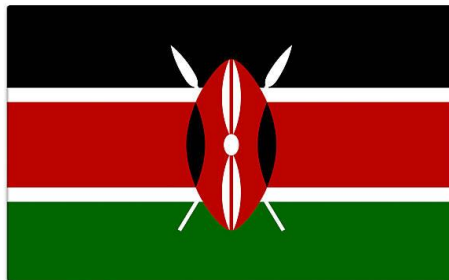
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ABSTRACT

To determine the types of pulmonary disease associated with human immunodeficiency virus (HIV) infection, we conducted a prospective study of 302 consecutive patients admitted for acute respiratory disease to a university hospital in Bujumbura, Burundi. Diagnoses were made according to well-defined criteria. Of the total, 222 patients (73.5%) were HIV seropositive, with women younger than men. Features suggestive of underlying HIV infection were the clinical findings of oral thrush, peripheral lymphadenopathy, or herpes zoster and the radiographic abnormalities of hilar-mediastinal adenopathy or a reticulonodular infiltrate. Tuberculosis and community-acquired pneumonia occurred with approximately equal frequency in the HIV-seropositive and seronegative groups. *Pneumocystis carinii* pneumonia was diagnosed in 11 patients, all seropositive. Gram-negative bacteremia, especially *Salmonella typhimurium*, occurred in 23 seropositive patients (10.4%). A total of 24 seropositive patients died during the initial hospitalization, and 11 others required readmission; no seronegative patients died or were rehospitalized. We conclude that HIV infection is a major risk factor for the development of acute respiratory diseases in adults of sufficient severity to require hospitalization in Bujumbura, Burundi. In this Central African country, where exposure to virulent bacterial pathogens is ubiquitous, tuberculosis, pneumonia, and salmonellosis occur with much greater frequency than classic AIDS-defining opportunistic infections or malignancies.

161 citations
(Sorted by Partner State)

Kenya



1. Adaptations and Lessons Learnt from Remote Research Data Collection during the COVID-19 Pandemic in Busia and Mandera Counties in Kenya

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ABSTRACT

BACKGROUND: The COVID-19 pandemic, while creating demand for data to inform response efforts, has had an impact on the conduct of biomedical and public health research. The research community has had to adapt its approaches to research in compliance with COVID-19 prevention measures. We highlight the adaptations made and lessons learnt in collecting research data remotely during the pandemic period from two rural communities in Kenya.

METHODOLOGY: The study was conducted in Busia and Mandera Counties, and employed a mixed method design. Consenting was done electronically via REDCap. Quantitative data was collected via e-survey on REDCap and qualitative data using telephone in-depth interviews. Study tools were piloted in Kajiado County to simulate implementation conditions. Community sensitization and mobilization was done primarily remotely, with the assistance of Research Assistants locally resident in the implementation counties. Local community health workers, trained virtually, were engaged to assist in the sampling and participant recruitment procedures in compliance to COVID-19 safety measures.

FINDINGS: Piloting proved crucial to informing adjustments of tools, minimizing time needed to complete study procedures remotely and anticipate potential technological challenges. Leveraging on local networks, personnel and partnerships facilitated buy-in from the community. Engaging community health workers through training and active involvement as trusted local resource aided successful sampling and data collection, and enabled participation of e-survey participants who lacked smartphones. Additionally, employing a data collection tool that could support online and offline data capture enabled navigation of internet connectivity issues. Coordination of study activities was done via dedicated WhatsApp groups, phone calls and supported by robust technical support. The team employed a number of modalities to ensure participation in qualitative procedures, including flexible working hours and holding targeted in-person interviews.

CONCLUSION: It is possible to carry out remote data collection in communities that are challenging to access, as currently occasioned by the COVID-19 pandemic, or in situations where resource constraints preclude traditional methods. This ultimately increases representativeness of research addressing the needs of communities that would otherwise be marginalized. However, successful implementation requires plans that incorporate contingency measures, a high

measure of flexibility and adaptability of the research team and customization of various online resources.

2. Factors That Influenced the Control of COVID-19 IN Border Counties.

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ABSTRACT

INTRODUCTION: Kenya's porous land borders remain a cause for concern among policymakers and public health experts who fear unchecked movement may contribute to the spread of COVID-19. Kenya's cross-border communities have strong trade, linguistic and cultural ties, which create a conducive environment for unchecked movement and interaction. We sought to understand the factors that may have influenced the control of the pandemic in border counties.

Methods: This was a qualitative study conducted in Busia and Mandera counties, seeking to understand factors that influenced the control of COVID-19 in border counties. Busia County shares a border with Uganda while Mandera County borders Ethiopia and Somalia. Purposive and snowball sampling methods were used to identify informant-rich respondents (n=73) for telephone interviews done using a tailored guide that addressed issues specific to the different study populations. They included policy makers, religious leaders, commercial sex workers, health care workers, truckers, businesspersons and Covid-19 survivors and cares. Data was managed using the framework method and analyzed thematically.

FINDINGS: A number of cross-border and health system factors that influenced the control of Covid-19 in the two border counties were noted. Cross-border facilitators of control of covid-19 included closure of manned border crossing, mandatory use of personal protective equipment, establishment of handwashing stations, screening and sample collection, harmonized testing, case management at point of detection, reporting across border points and pre-existing cross-border health committees (Mandera), while barriers included long testing turnaround time, crowding of truckers (Busia), stock outs of test kits and sample collection kits, existence and use of informal border crossings and slight differences in response strategies across the borders that fueled stigma. Health system factors that facilitated control of covid-19 included designated quarantine and isolation facilities, evacuation and testing services, community sensitization on covid-19, contact tracing, and a robust disease surveillance network (Mandera), while barriers were the proximity of testing labs, resource (infrastructure and PPEs) constraints, as well as shared culture and language among border communities that complicated contact tracing.

CONCLUSION: Facilitating factors and county-specific innovations can be replicated in other border counties to strengthen control of COVID -19. Border counties bear disproportionate exposure to and burden of COVID-19. There is need for multi-sectoral efforts in resourcing, enhancing health education and enforcing COVID-19 control measures.

3. Researchers' Experience on Diary Data Collection during COVID-19 Pandemic

Esther A Shiraho¹; Priscilla Maiga¹; Miriam Bosire¹; Melvin Ochieng¹; Schiller Mbuka¹; Doreen Mitaru¹; Rodgers Ochieng ¹; Ismail Adow¹; Erastus Muniu¹; Joanna Olale¹; Joseph Mutai¹; Lydia Kaduka¹; Seeromanie Harding²

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ABSTRACT

BACKGROUND: Diaries are gaining ground in qualitative research as a tool for collecting first-hand information on participants' experiences. While there exists information on participants' experience of diary keeping process, limited documentation is available on researchers' experience in implementation of the same. We highlight researchers' experiences while engaging study participants in remote diary data collection during the covid-19 pandemic.

METHODS: Researchers' experiences are based on qualitative diary data collection by participants in Busia and Mandera counties of Kenya. Fourteen researchers were virtually engaged - 6 actively engaged participants, 4 were supervisors, 2 liaison (researchers-communities), and 2 collaborators. Online training was conducted via Zoom platform. Community Health Extension Workers (CHEWs) in the respective counties identified prospective participants for training and enrolment. 29 participants consented electronically, and were paired with 6 researchers who offered further training and advice on diary keeping methods. Researchers who were paired with a maximum of 5 participants shared prompts on daily basis to guide on diary entries (DEs), conducted preliminary analysis of shared DEs, compiled individual DEs and archived the same upon approval by the participant. Researchers documented their experiences during this process. Prompts shared with participants served as a template guide for capturing researchers' experiences.

FINDINGS: Training was generally successful as most participants had smart phones and conversant with the Zoom application. However, the few who lacked smart phones or experienced poor network connection opted to share devices with their counterparts, a common scenario in Mandera County. Repeated training helped reinforce study requirements and expectations. Majority (n=11) of the participants opted to keep handwritten diaries, 8 opted to share their DEs directly as WhatsApp message; 2 kept audio diaries; 1 typed in MS Word and 4 used both handwritten and WhatsApp text messages, all of which were shared through WhatsApp. Regular interactive online meetings among researchers enhanced understanding and mitigation of

challenges encountered during this process. The pairing between the researchers and participants fostered trust, bonding, understanding and ease in communication. There was high retention of enrolled participants who remitted 14 DEs within 14 days. Others remitted fewer DEs and took 31 days maximum. When asked how they felt about dairying, all participants gave positive feedback.

CONCLUSION: Key lessons learnt were that the blended research team provided a strong support system amongst researchers and researcher-participant pairing was a novel approach that kept participants engaged and minimized fatigue associated with the diary keeping process. Constant tailored support and flexibility are key for successful diary data collection, especially where personal contact is limited.

4. Health-Care Workers' Perspectives on Preparedness for Outbreak of Communicable Diseases At Kericho County Referral Hospital, Kericho County.

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ABSTRACT

BACKGROUND: Kenya is currently experiencing an increase in the emergence of infectious agents leading to several disease outbreaks and pandemics. Health-care facilities play a critical role in response to outbreaks. Multiple frameworks and legislations call for a collaborative and holistic approach in outbreak preparedness and response. Kericho County Referral Hospital, is a level V Hospital and a current COVID-19 Centre in Kenya. This study draws its relevance from the above concerns; to investigate the health-care workers' perspectives on the preparedness of Kericho County Referral Hospital for communicable diseases' outbreak. **Methods:** The study was based on a descriptive cross sectional study design. It comprised 31 participants from multiple departments. Convenience and Purposive sampling techniques were used. An online based questionnaire and an observation list were used to collect data. Qualitative data was analyzed through thematic analysis while quantitative data was analyzed through descriptive statistics and summarized based on a scoring scale unique to the study where; 81-120= averagely prepared; 121-160= well prepared.

RESULTS: Quantitative data results. The health-care workers' perceived the hospital to have succeeded in waste management (150) and sustaining routine health services (139). They perceived the following sectors as averagely prepared; human resource (102), non-pharmaceutical resources (118), training (116), emergency committee (114), communication (98) and monitoring and evaluation (103). Qualitative data results. Perceived barriers to multi-sectoral preparedness were inadequate resources, inadequate training, inadequate infrastructure and inadequate staff. Kericho County Referral Hospital has implemented a multi-sectoral approach in preparedness for outbreak of communicable diseases. The hospital should address the shortcomings in averagely prepared departments promptly. Further similar studies to be carried

out with a larger sample size and equal distribution across departments. Pandemics Preparedness, Surveillance Response, and Travel Medicine has been passed on, from generation to generation contributing to more than 70% of Africa population reliant to traditional medicine for therapy according to WHO. The desire by Kenyans to keep COVID-19 at bay has compelled them to explore home-based remedies. The most commonly known remedy is dawa which has become increasingly very popular and as part of a herbal drink for most households in Kenya after Covid-19 pandemic. Dawa which is a Kiswahili word meaning drug/medicine in English, is a herbal decoction consisting of several food herbs, commonly used for self-treatment when one has cold. The decoction contains but not limited to, ginger, garlic, lemon and turmeric. Our focus is on the contents of this dawa that has become very popular in Kenya. Methods: Selection of the food herbs was based on combination of spices commonly used in Kenya to self-treat cold. The review was done by searching databases like PubMed, and Google Scholar for articles related to ginger, garlic, turmeric and lemon, specifically focusing on Covid-19, the articles were collected and reviewed.

RESULTS: The search focused on use of ginger, garlic, turmeric and lemon in Covid-19, 351 and 2 papers were retrieved from google scholar and pubmed, respectively. Papers published since January year 2020 to April 2021 were 228. Their titles and abstracts were screened for eligibility. Finally, 103 records were included for the full-text monitoring, and 60 qualified articles, including manual search papers remained for the final data extraction. A remarkable increase use of ginger, garlic, turmeric and lemon in response to COVID-19 was noted.

CONCLUSION: Dawa is believed to boost immune system which strengthen the body immunity to fight disease and this may contribute to alleviating symptoms, reducing the severity of the virus and improving recovery rates which could finally reduce the mortality rate. This could only be attributed to the fact that the food herbs that combine to make dawa have a lot of health benefit individually and collectively. It is important to carry out clinical trial to inform whether indeed the component of this dawa prevent or improve recovery rate of Covid-19 patients.

5. Impact of COVID -19 diagnostic services on HIV viral load (VL) and Early Infant Diagnosis (EID) turn-around-time (TAT) in a reference testing laboratory in Kenya.

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ABSTRACT

BACKGROUND: In Kenya, the first case of COVID-19 was reported in March, 2020. The testing of SARS-CoV-2, which causes COVID-19 was integrated into the molecular diagnostics infrastructure already in place for HIV Viral Load and Early Infant Diagnosis of HIV. It is unknown whether this shift had any impact on VL and EID testing services in the relevant laboratories. Our study assessed the impact of COVID-19 testing on HIV VL and EID testing TAT in laboratories in Kenya.

METHODS: HIV VL and EID data on TAT collected between January 2019 to December 2020 was abstracted from the HIV NASCOP database. The mean TAT for the year 2019, January to March 2020 (just before Covid-19 testing commenced) and April to December 2020 were computed to check for an increase or decline in average TAT. Data analysis was conducted using STATA SE 14 for Windows.

RESULTS: The mean TAT for VL in 2019 was 6 days. Between January to March 2020, the mean TAT was 8 days. Between April to December 2020, the mean TAT was 11 days. The mean TAT for EID in 2019 was 5 days, while it was 9 days between January to March 2020. The average TAT was 8 days between April and December 2020.

CONCLUSION: The increase in VL and EID average TAT observed throughout the study period could be attributed to the fact that the Covid-19 tests as well as HIV had to be tested on the few already overstretched equipment and with the limited human resources available. However, the TAT could have also been affected by other factors that have not been examined in this study, for instance reagent stock outs and machine breakdowns. In the face of another pandemic in future it would be important that the relevant stakeholders increase manpower, mitigate on frequent stock outs and provide prompt action on machine breakdowns.

6. Effect of covid-19 pandemic response measures on social life in two border counties of Kenya.

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ABSTRACT

BACKGROUND: The Kenyan government in its effort to control the spread of SARS-CoV-2 instituted mitigation measures that included curfews, restrictions in movement, trade, and religious & social gatherings. These measures had adverse effects on social life, health and wellbeing of Kenyans. This study sought to understand the effect of the pandemic on social life in Busia and Mandera border counties in Kenya to inform covid-19 response.

METHODS: The study adopted a mixed methods research approach conducted in Busia and Mandera counties. Quantitative data was collected through a household e-survey (n=582 adults). Changes in daily life due to the covid-19 crisis was assessed as well as available social structures and a general sense of distress in respondents. For qualitative study arm, purposive sampling method was used to identify key informants (n=73) who participated in telephone interviews. They

included policy actors, healthcare workers, Covid survivors & carers, truckers, traders and religious leaders. A guide was used to unearth the effects of the pandemic on social life. Quantitative data was analyzed using SPSS version 22 while qualitative data was coded & categorized using the Framework method, and manual thematic analysis done. Ethical considerations were met. Results: Out of 582 adult participants (M: 43%; F: 57%), 81.4 % reported food insecurity, major changes in social interaction (23.5%), change in quality of relationships with friends and family for worse (59.4%), lack of access to schooling (87.5%) and difficulties in maintaining social distance (82.1%). Respondents reported disruption to religious support (65.5 %), peer support group (21.8%), merry-go-round/chamas (33.2%) and 19.9% sporting activities. 84.7% reported a sense of distress 82.8% of 101 participants in informal sector reported loss of income. Majority of social networks/ links (peer groups, religious networks, families) were disrupted by movement restrictions, curfews and closure of educational institutions. The changes in quality of social relationships reported were largely negative with a number of potential long-term consequences on educational attainment (teen pregnancies likely to affect educational attainment for girls) and family structure and stability (marriages were affected by loss of income and financial strain, divorce, separation). Cases of gender-based violence and suicide were reported. There was convergence of the quantitative and qualitative findings, both of which indicated the pandemic had a generally adverse effect on social life. The qualitative findings provided insights into the lived realities underlying the quantitative findings of the study and aided in identifying recommendations to inform the pandemic response.

7. Temporal trends of SARS-CoV-2 seroprevalence in transfusion blood donors during the first wave of the COVID-19 epidemic in Kenya

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ABSTRACT

INTRODUCTION: Observed SARS-CoV-2 infections and deaths are low in tropical Africa raising questions about the extent of transmission. In this further study, we examine the dynamics of SARS-CoV-2 seroprevalence among Kenyan blood donors throughout the course of the first epidemic wave.

METHODS: From 30th April to 30th September 2020, samples from blood donors aged 16-64 years were collected at six Kenya National Blood Transfusion Service (KNBTS) regional blood transfusion centres across Kenya. We measured SARS-CoV-2 IgG by ELISA in 9,922 blood donors and adjusted for sampling bias and test performance.

RESULTS: By 1st September 2020, 577 COVID-19 deaths were observed nationwide and seroprevalence was 9.1% (95%CI 7.6-10.8%). Seroprevalence in Nairobi was 22.7% (18.0-27.7%).

CONCLUSION: Although most people remained susceptible, SARS-CoV-2 had spread widely in Kenya with apparently low associated mortality.

8. Understanding how COVID-19 pandemic influenced pharmaceutical care services: a qualitative study of retail pharmacy providers' and clients' experiences in Thika, Kenya.

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ABSTRACT

BACKGROUND: In Kenya, retail pharmacies bridge an important gap in the provision of essential healthcare services, with prior research suggesting that many Kenyans first resort to retail pharmacies for both preventative and urgent care needs, as well as minor ailments. We conducted a qualitative study with pharmacy clients and providers to understand whether and how the COVID-19 pandemic has influenced their care-seeking and service provision at retail pharmacies.

METHODS: From October to December 2020, we conducted 30 in-depth interviews with pharmacy clients (N=20) and providers (N=10) in Thika, Kenya. Eligible individuals were ≥18 years and seeking or providing care at a retail (non-hospital) pharmacy. Interviews were

conducted using a semi-structured guide, audio recorded, and transcribed verbatim. Two trained researchers analyzed transcripts using content analysis.

RESULTS: Providers' median age was 28 years (IQR: 24-41) and half (N=5) were male; clients median age was 25 years (IQR: 21-46) and half (N=10) were female. Most clients reported reducing the frequency of their visits to the pharmacy during the pandemic due to fear of contracting the virus, noting that some pharmacies were crowded and not adhering to COVID-19 precaution guidelines. A few clients additionally described stocking up on products they needed from the pharmacy or resorting to using home remedies during the pandemic. By contrast, some clients reported visiting the pharmacy more frequently during the pandemic to seek COVID-19 information and prevention products (e.g., sanitizers, gloves). Most providers noted lowered profit margins during the pandemic due to decreased client volume and reduced opening hours. Some providers also reported selling products at a loss or at no profit to avoid losing clients and increased operational costs to implement COVID-19 precautions (e.g., handwashing stations).

CONCLUSION: Despite increased operational costs and dwindling profit margins, the retail pharmacies in this study continued to provide health services during the pandemic and served as a primary source of COVID-19 information and prevention products for clients. These findings highlight a potential opportunity for collaboration between retail pharmacies and COVID-19 prevention efforts.

9. COVID-19 Outbreak Investigation and Response in Nyeri County Kenya, 2020

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ABSTRACT

INTRODUCTION: The novel COVID-19 pandemic, caused by severe acute respiratory syndrome coronavirus 2, remains a global challenge. Following community transmission, increase in number of positive cases, mortality and untraced contacts in Nyeri, we described the epidemiology of cases, conducted contact tracing and instituted control measures.

METHODOLOGY: Using a standard data abstraction tool we reviewed Nyeri county and national line list, contact list and follow up records. We conducted contact tracing for all active cases by use of a phone calls, contact was defined as any person who got exposed to a probable or confirmed case during the 2 days before and the 14 days after the onset of symptoms of the case. We conducted sensitization to county health managers on data management and surveillance and key informant interviews to assess COVID-19 preparedness and response. We performed descriptive statistics and case series for cases at Nyeri main prison.

RESULTS: As at 22nd October 2020 Nyeri County had listed 313 COVID-19 cases with 13 deaths (CFR= 4.2%). Index case was on recorded on May 22, 2020. Of the 313 cases 195 (63%) were male, the median age was 36 years (IQR=24), asymptomatic cases were 260 (83%), Nyeri main prison contributed 10% (30) while health workers accounted for 12% (39) of the cases. We listed and traced 69 contacts, however no contact was listed for the prison cases. We capacity built 19 health managers on data management. For preparedness there was an incident command system with one arm chaired by the governor and the technical arm by county director health. There was a rapid response team with surveillance, logistics, laboratory and case and data management functions at the county and sub county levels. There were 6 public isolation centers with a bed capacity of 339.

CONCLUSION: After sharing of findings Nyeri county-initiated line listing of the cases using the updated tools and continued tracing of contact(s) of all confirmed cases, and reports sent to the national team on a regular basis. We recommended enhanced contact tracing among the resident of the prisons.

10. A Description of Covid-19 Cases in Nyeri County, Kenya, January 2021

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ABSTRACT

INTRODUCTION: Nyeri county had confirmed 1245 cases as of 15th January 2021 cumulatively with an associated 45 deaths (CFR=3.6%). The county has a high burden of non-communicable diseases hence likely to worsen the outcome. There were reports of rapid transmission of COVID-19 among inmates at Nyeri main prison and in the general population. The team sought to characterize COVID-19 cases admitted at the three isolation centers in Nyeri County and Nyeri main prison, describe medication patterns in private chemists and describe home remedies used by patients under home-based care.

METHODS: The investigation was carried out from January 11–17, 2021. Data were abstracted from the health facilities registers of the three isolation centers; Outspan, KNH annex, & Mt. Kenya hospital. Nyeri prison & County and national line lists were also reviewed using a standard template and aggregated into an MS Excel spreadsheet. Semi-structured questionnaires were used to interview COVID-19 patients under home-based care and the drug dispensers. Twelve chemists were purposively sampled. Data were analyzed using Epi Info 7. We calculated measures of central tendency and dispersion for continuous variables and proportions and frequencies for categorical variables.

RESULTS: We reviewed 1245 COVID-19 records from the line list; 172 (13.8%) were admitted at the three isolation centers for COVID-19, while all the 152 (12.2%) cases isolated at Nyeri main prison were all male. The median length of stay at the prison isolation was 3 weeks with a range of 3 to 6 weeks. There were 45 deaths (CFR =3.6 %), Of the 45 COVID -19 patients who died,29, (64) percent presented to the hospitals with difficulty in breathing and were not aware of their COVID 19 status, 26, (58%) had known comorbidities with diabetes contributing the highest proportion 22, (49%), Nine (75%) of the 12-private chemists were visited; the in-charges reported to know now know about the drugs used to manage COVID-19 patients. About 73.97% (921/1245) of the patients were under homebased care. As regards home remedies; of the 30 patients interviewed, all 30, (100%) used hot water, 27 (90%) reported using lemon juice and only 9 (30%) used other fruits and garlic.

CONCLUSION AND RECOMMENDATION: All deaths were from severe cases who presented with difficulty in breathing, we capacity-built the prison health records team on filling of the line list. We recommended continued health education on the use of home remedies for COVID-19 prevention and control.

11. COVID-19 Investigation and Response in Uasin Gishu County, Kenya

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Proceedings of the 11th KEMRI Annual Scientific & Health (KASH) Conference 2021; unpublished.

ABSTRACT

INTRODUCTION: COVID-19 has affected the economy, the health sector and caused social disruption of the livelihood of millions of people globally. By March 30, 2021, Kenya had reported 131,115 cases and 2,135 deaths. Uasin Gishu County experienced a marked increase in number of cases in March 2021. The county acts as the main commercial center in Northern Rift Valley and some Western Counties. We described the magnitude of COVID-19 and assessed COVID-19 preparedness and response in the County. **Methods:** We described the line listed COVID-19 confirmed cases as of April 14, 2021, in six sub counties in Uasin Gishu County. The cases were characterized according to demographics, clinical presentation and admission status. We assessed the preparedness and response of isolation centers on case management, infection prevention control, waste management, cases follow-up. Analysis of continuous variables generated mean and range, while categorical variables generated measures of central tendency and dispersions.

RESULTS: Of 4,300 COVID-19 records analyzed, 2,566 (59%) were for males. The mean age was 37.8 years (± 8.4), most affected age category was 30-39 years at 27.3%. Most affected occupation were business persons at 438 (10.2%). Only 351 (5.9%) had symptoms with 140 (40%) exhibiting cough and 135(3.1%) had died. A total of 2,573 (59.8%) had been put under

Home Based Isolation and Care (HBIC) and 537(12.5%) had been admitted in health facilities since the first case was reported. Ainabkoi subcounty had the highest infections 2,292 (53.3%). The county had a total of 144 isolation beds with 55 beds in public facilities and 89 beds in private facilities. The total number of beds in Intensive Care Units/High Dependency Units were 13. Of the 2,642 health workers in 11 health facilities, 856 (32.4%) were trained on PPEs use and 6 (54.5%) of the facilities contract private firms for waste management. Three of the eleven health facilities had Home Base Care (HBC).

CONCLUSION: The impact of the Covid-19 pandemic has disproportionately affected different occupations with highest infections noted on the businesspersons; while 30 - 39 age group had the highest infection rates. With increase in cases within the county, there is need for increase in number of isolation beds to cater for increase rate of hospitalization. The county government should also make use public isolation centers to ease congestion from private facilities.

12. High seroprevalence of SARS-CoV-2 but low infection fatality ratio eight months after introduction in Nairobi, Kenya.

Ngere I¹, Dawa J¹, Hunsperger E², Otieno N³, Masika M⁴, Amoth P⁵, Makayotto L⁶, Nasimiyu C¹, Gunn BM⁷, Nyawanda B³, Oluga O⁶, Ngunu C⁶, Mirieri H¹, Gachohi J⁸, Marwanga D¹, Munywoki PK², Odhiambo D³, Alando MD³, Breiman RF⁹, Anzala O⁴, Njenga MK¹, Bulterys M², Herman-Roloff A², Osoro E¹⁰.

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Int J Infect Dis. 2021 Sep 2: S1201-9712(21)00696-2. doi: 10.1016/j.ijid.2021.08.062. Online ahead of print.

ABSTRACT

BACKGROUND: The lower-than-expected COVID-19 morbidity and mortality in Africa has been attributed to multiple factors, including weak surveillance. We estimated the burden of SARS-CoV-2 infections eight months into the epidemic in Nairobi, Kenya.

METHODS: We conducted a population-based cross-sectional survey using multi-stage random sampling to select households within Nairobi in November 2020. Sera from consenting household members were tested for antibodies to SARS-CoV-2. Seroprevalence was estimated after

adjusting for population structure and test performance. Infection fatality ratios (IFRs) were calculated by comparing study estimates to reported cases and deaths.

RESULTS: Among 1,164 individuals, the adjusted seroprevalence was 34.7% (95%CI 31.8-37.6). Half the enrolled households had at least one positive participant. Seropositivity increased in more densely populated areas (spearman's $r=0.63$; $p=0.009$). Individuals aged 20-59 years had at least 2-fold higher seropositivity than those aged 0-9 years. The IFR was 40 per 100,000 infections, with individuals ≥ 60 years old having higher IFRs.

CONCLUSION: Over one-third of Nairobi residents had been exposed to SARS-CoV-2 by November 2020, indicating extensive transmission. However, the IFR was >10 -fold lower than that reported in Europe and the United States, supporting the perceived lower morbidity and mortality in sub-Saharan Africa.

13. COVID-19 implications on household income and food security in Kenya and Uganda: Findings from a rapid assessment.

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World Dev. 2021 Jan; 137:105199. doi: 10.1016/j.worlddev.2020.105199. Epub 2020 Sep 18.

ABSTRACT

This study assessed implications of the Coronavirus Disease 19 (COVID-19) pandemic on household income and food security in two East African countries - Kenya and Uganda, using online survey data from 442 respondents. Results show that more than two-thirds of the respondents experienced income shocks due to the COVID-19 crisis. Food security and dietary quality worsened, as measured by the food insecurity experience scale and the frequency of consumption of nutritionally-rich foods. The proportion of food insecure respondents increased by 38% and 44% in Kenya and Uganda respectively, and in both countries, the regular consumption of fruits decreased by about 30% during the COVID-19 pandemic, compared to a normal period (before the pandemic). Results from probit regressions show that the income-poor households and those dependent on labour income were more vulnerable to income shock, and had poorer food consumption during the COVID-19 pandemic compared to other respondent categories. As such, they were more likely to employ food-based coping strategies compared to those pursuing alternative livelihoods, who generally relied on savings. Farmers were less likely to experience worsened food security compared to other respondent categories who depended to a great extent on market sources for food. In both countries, participation in national social security schemes was less likely to mitigate respondents' income shock during the COVID-19 period. Conversely, membership in savings and loan groups was correlated with less likelihood of suffering income shocks and reduction in food consumption. The results suggest that ongoing and future

government responses should focus on structural changes in social security by developing responsive packages to cushion members pushed into poverty by such pandemics while building strong financial institutions to support the recovery of businesses in the medium term, and ensuring the resilience of food supply chains particularly those making available nutrient-dense foods.

14. A baseline review of the ability of hospitals in Kenya to provide emergency and critical care services for COVID-19 patients.

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Afr J Emerg Med. 2021 Jun;11(2):213-217. doi: 10.1016/j.afjem.2021.01.001. Epub 2021 Jan 18.

ABSTRACT

INTRODUCTION: As the Coronavirus Disease 2019 (COVID-19) cases in Kenya begin to rise, the number of severe and critical COVID-19 patients has the potential to quickly overload the local healthcare system beyond its capacity to treat people.

OBJECTIVE: The purpose of this study was to gather information about the ability of hospitals in Kenya to provide emergency and critical care services and to identify priority actions for use by policymakers and other stakeholders as a roadmap toward strengthening the COVID-19 response in the country.

METHODS: This was a comprehensive review of the published and grey literature on emergency and critical care services in Kenya published in the last three years through April 2020. Screening of articles was conducted independently by the authors and the final decision for inclusion was made collaboratively. A total of 15 papers and documents were included in the review.

KEY RECOMMENDATIONS: There is an urgent need to strengthen prehospital emergency care in Kenya by establishing a single toll-free ambulance access number and an integrated public Emergency Medical Services (EMS) system to respond to severe and critical COVID-19 patients in the community and other emergency cases. Functional 24-h emergency centres (ECs) need to be established in all the level 4, 5 and 6 hospitals in the country to ensure these patients receive immediate lifesaving emergency care when they arrive at the hospitals. The ECs should be equipped with pulse oximeters and functioning oxygen systems and have the necessary resources and skills to perform endotracheal intubation to manage COVID-19-induced respiratory distress and hypoxia. Additional intensive care unit (ICU) beds and ventilators are also needed to ensure continuity of care for the critically ill patients seen in the EC. Appropriate practical interventions should be instituted to limit the spread of COVID-19 to healthcare personnel and other patients within the healthcare system. Further research with individual facility levels of assessment around infrastructure and service provision is necessary to more narrowly define

areas with significant shortfalls in emergency and critical care services as the number of COVID-19 cases in the country increase.

15. COVID-19 and mental well-being of nurses in a tertiary facility in Kenya.

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PLoS One. 2021 Jul 1;16(7):e0254074. doi: 10.1371/journal.pone.0254074. eCollection 2021.

ABSTRACT

BACKGROUND: The 2019 coronavirus disease (COVID-19) epidemic is a global health emergency which has been shown to pose a great challenge to mental health, well-being and resilience of healthcare workers, especially nurses. Little is known on the impact of COVID-19 among nurses in sub-Saharan Africa.

METHODS: A cross sectional study was carried out between August and November 2020 among nurses recruited from the Aga Khan University Hospital, Nairobi. The survey questionnaire consisted of six components- demographic and work title characteristics, information regarding care of COVID-19 patients, symptoms of depression, anxiety, insomnia, distress and burnout, measured using standardized questionnaires. Multivariable logistic regression analysis was performed to identify factors associated with mental health disorders.

RESULTS: Of 255 nurses, 171 (67.1%) consented to complete the survey. The median age of the participants was 33.47 years, 70.2% were females and 60.8% were married. More than half, 64.9% were frontline workers directly engaged in COVID-19 care. Only 1.8% reported a prior history or diagnosis of any mental health disorder. Depression, anxiety, insomnia, distress, and burnout were reported in 45.9%, 48.2%, 37.0%, 28.8% and 47.9% of all nurses. Frontline nurses reported experiencing more moderate to severe symptoms of depression, distress and burnout. Furthermore, females reported more burnout as compared to males.

Multivariate logistic regression analysis showed that after adjustment, working in the frontlines was an independent risk variable for depression and burnout.

CONCLUSION: This is one of the few studies looking at mental health outcomes among nurses during the COVID-19 pandemic in Kenya. Similar to other studies from around the world, nurses directly involved with COVID-19 patients reported higher rates of mental health symptoms. Burnout threatens to exacerbate the pre-existing severe nursing workforce shortage in low-resource settings. Cost-effective and feasible mitigating strategies, geared to low-middle income countries, are urgently needed to help cope with mental health symptoms during such a pandemic.

16. Pooled testing conserves SARS-CoV-2 laboratory resources and improves test turn-around time: experience on the Kenyan Coast.

Agoti CN^{1,2}, Mutunga M¹, Lambisia AW¹, Kimani D¹, Cheruiyot R¹, Kiyuka P¹, Lewa C¹, Gicheru E¹, Tendwa M¹, Said Mohammed K¹, Osoti V¹, Makale J¹, Tawa B¹, Odundo C¹, Cheruiyot W¹, Nyamu W¹, Gumbi W¹, Mwacharo J¹, Nyamako L¹, Otieno E¹, Amadi D¹, Thoya J¹, Karani A¹, Mugo D¹, Musyoki J¹, Gumba H¹, Mwarumba S¹, M Gichuki B¹, Njuguna S¹, Riako D¹, Mutua S¹, Gitonga JN¹, Sein Y¹, Bartilol B¹, Mwangi SJ¹, O Omuoyo D¹, M Morobe J¹, de Laurent ZR¹, Bejon P^{1,3}, Ochola-Oyier L¹, Tsofa B¹.

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Wellcome Open Res. 2021 Feb 3; 5:186. doi: 10.12688/wellcomeopenres.16113.2. eCollection 2020.

ABSTRACT

BACKGROUND: International recommendations for the control of the coronavirus disease 2019 (COVID-19) pandemic emphasize the central role of laboratory testing for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the etiological agent, at scale. The availability of testing reagents, laboratory equipment and qualified staff are important bottlenecks to achieving this. Elsewhere, pooled testing (i.e. combining multiple samples in the same reaction) has been suggested to increase testing capacities in the pandemic period.

METHODS. We discuss our experience with SARS-CoV-2 pooled testing using real-time reverse transcription polymerase chain reaction (RT-PCR) on the Kenyan Coast.

RESULTS. In mid-May, 2020, our RT-PCR testing capacity for SARS-CoV-2 was improved by ~100% as a result of adoption of a six-sample pooled testing strategy. This was accompanied with a concomitant saving of ~50% of SARS-CoV-2 laboratory test kits at both the RNA extraction and RT-PCR stages. However, pooled testing came with a slight decline of test sensitivity. The RT-PCR cycle threshold value (Δ Ct) was ~1.59 higher for samples tested in pools compared to samples tested singly.

CONCLUSIONS. Pooled testing is a useful strategy to increase SARS-CoV-2 laboratory testing capacity especially in low-income settings.

17. Life in the Balance: Young Female Sex Workers in Kenya Weigh the Risks of COVID-19 and HIV.

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AIDS Behav. 2021 May;25(5):1323-1330. doi: 10.1007/s10461-020-03140-5. Epub 2021 Jan 2.

ABSTRACT

The COVID-19 pandemic has had serious health, economic and psychosocial consequences. Marginalized populations including female sex workers face the stark choice of risking exposure to SARS-CoV-2 as they engage with clients or prioritizing their health at the cost of losing a primary source of income. As part of an ongoing open-label, randomized controlled trial providing daily oral pre-exposure prophylaxis and adherence support, we interviewed 193 of 200 enrolled young female sex workers (18-24 years) in Kisumu, Kenya, about COVID-19 awareness and precautions, access to health services, and sex work during Kenya's pandemic-related lockdown. Nearly all participants were aware of COVID-19 and reported taking protective measures, but only half reported concerns about acquiring SARS-CoV-2. Night curfews and bar closures adversely affected participants' sex work business, reducing the number of clients and payment amounts from clients. Nearly 15% experienced violence from a client or regular, non-paying sex partner during the lockdown period. Participants' access to healthcare services was not disrupted.

18. Age-structured model for COVID-19: Effectiveness of social distancing and contact reduction in Kenya.

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Infect Dis Model. 2021;6:15-23. doi: 10.1016/j.idm.2020.10.012. Epub 2020 Nov 10.

ABSTRACT

Coronavirus disease 2019 is caused by severe acute respiratory syndrome coronavirus 2. Kenya reported its first case on March 13, 2020 and by March 16, 2020 she instituted physical distancing strategies to reduce transmission and flatten the epidemic curve. An age-structured

compartmental model was developed to assess the impact of the strategies on COVID-19 severity and burden. Contacts between different ages are incorporated via contact matrices. Simulation results show that 45% reduction in contacts for 60-days period resulted to 11.5-13% reduction of infections severity and deaths, while for the 190-days period yielded 18.8-22.7% reduction. The peak of infections in the 60-days mitigation was higher and happened about 2 months after the relaxation of mitigation as compared to that of the 190-days mitigation, which happened a month after mitigations were relaxed. Low numbers of cases in children under 15 years was attributed to high number of asymptomatic cases. High numbers of cases are reported in the 15-29 years and 30-59 years' age bands. Two mitigation periods, considered in the study, resulted to reductions in severe and critical cases, attack rates, hospital and ICU bed demands, as well as deaths, with the 190-days period giving higher reductions.

19. **Assessing the Level and Determinants of COVID-19 Vaccine Confidence in Kenya.**

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Vaccines (Basel). 2021 Aug 23;9(8):936. doi: 10.3390/vaccines9080936.

ABSTRACT

The government of Kenya has launched a phased rollout of COVID-19 vaccination. A major barrier is vaccine hesitancy; the refusal or delay of accepting vaccination. This study evaluated the level and determinants of vaccine hesitancy in Kenya. We conducted a cross-sectional study administered through a phone-based survey in February 2021 in four counties of Kenya. Multilevel logistic regression was used to identify individual perceived risks and influences, context-specific factors and vaccine-specific issues associated with COVID-19 vaccine hesitancy. COVID-19 vaccine hesitancy in Kenya was high: 36.5%. Factors associated with vaccine hesitancy included: Rural regions, perceived difficulty in adhering to government regulations on COVID-19 prevention, no perceived COVID-19 infection risk, concerns regarding vaccine safety and effectiveness, and religious and cultural reasons. There is a need for the prioritization of interventions to address vaccine hesitancy and improve vaccine confidence as part of the vaccine roll-out plan. These messaging and/or interventions should be holistic to include the value of other public health measures, be focused and targeted to specific groups, raise awareness on the risks of COVID-19 and effectively communicate the benefits and risks of vaccines.

20. **Knowledge, attitudes, practices, and the effects of COVID-19 among the youth in Kenya.**

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BMC Public Health. 2021 May 30;21(1):1020. doi: 10.1186/s12889-021-11067-2.

ABSTRACT

BACKGROUND: Cases of the Corona Virus Disease of 2019 (COVID-19) in Kenya have continued to increase rapidly, since the first case in the country was confirmed in March 2020. In the wake of the pandemic, the health and socio-economic challenges experienced by the youth in Kenya are likely to be elevated. We assessed knowledge, practices, perceived risk of infection, adoption of recommended behavior and the effects of COVID-19 among the youth in Kenya.

METHODS: A cross sectional descriptive study was conducted between April 30th to May 7th, 2020 through a combined online survey and phone interviews. A total of 2156 youth across all 47 counties in Kenya completed the responses to the study questions. All survey responses analyzed using Stata version 15 were tabulated by gender, age, and education level to generate basic descriptive tables and tested for differences by category using chi-square tests. Where applicable, linear and logistic regression analysis model was conducted using covariates such as employment status, gender, and education level.

RESULTS: Knowledge on symptoms of COVID-19 was generally high. Female respondents were more likely to identify more symptoms correctly compared to men ($p < 0.001$). However, youth reported very low levels of anyone being at risk of infection (7.1%). Most youth have adopted behavior necessary to slow down the infection. There were generally very low reported levels of inability to access health services related to sexual and reproductive health. About 50.0% of respondents reported significant decline in income during the pandemic period, nearly a third reported living in fear while 26.5% reported feeling stressed.

CONCLUSION: There was high knowledge of COVID-19 symptoms, preventive strategies, and high adoption of preventive practices. Strategies to sustain behaviors positively adopted among young people will be critical to reduce the spread of COVID-19. Despite the low reported rates of inability to access sexual and reproductive health, response measures should include strategies that facilitate continuity of services among young people. The reported social effects of the pandemic show the need for interventions to meet the health and socio-economic needs of the youth and minimize the long-term consequences of the pandemic.

21. Perceived risks of infection, hospitalization, and death from COVID-19 at the Equator: Ecuador and Kenya.

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Disaster Med Public Health Prep. 2021 Aug 16:1-17. doi: 10.1017/dmp.2021.268. Online ahead of print.

ABSTRACT

OBJECTIVES: This study's goal was to determine the perceived risks of infection as well as the perceived risks of hospitalization and death from COVID-19 in Ecuador and Kenya. It also assessed the factors associated with the risk-related perceptions.

METHODS: Cross-sectional studies with samples from the adult populations in both countries were conducted to assess the perceived risks of contracting COVID-19. Data were collected online using the Qualtrics platform from samples of 1,050 heads of households ages 18 years or older in each country. Three statistical analyses were conducted: summary statistics, correlation, and linear regression.

RESULTS: The average perceived risks of COVID-19 infection, hospitalization, and death in the Kenyan sample were 27.1%, 43.2%, and 17.2%, respectively, and the values for the Ecuadorian sample were 34%, 32.8%, and 23.3%, respectively. The Pearson's correlation coefficients between the risk measures in each country were less than 0.38. Risk measures were associated with several sociodemographic variables (e.g., income, gender, location) but not age.

CONCLUSIONS: The perceived risks of COVID-19 infection, hospitalization, and death in Kenya and Ecuador were significantly higher relative to the statistics reported; however, no strong association existed between perceived risk and age, which is a key factor in adverse health outcomes, including death, among COVID-19 infected individuals.

22. The Effect of COVID-19 and Its Control Measures on Sexual Satisfaction Among Married Couples in Kenya.

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Sex Med. 2021 Jun;9(3):100354. doi: 10.1016/j.esxm.2021.100354. Epub 2021 Mar 19.

ABSTRACT

BACKGROUND: COVID-19 was first diagnosed in Kenya in March 2020 following which the government instituted control measures which could have affected people's sexual satisfaction and overall quality of life including restrictions in travels; ban on alcohol consumption and closure of bars; 9 pm to 5 am curfew; ban on political rallies, and closure of many workplaces with people being encouraged to work from home. **AIM:** The objective of this study was to determine how perceived and experienced sexual satisfaction changed with the advent of COVID-19 among heterosexual married individuals in Kenya.

METHODS: The study was a cross-sectional survey. Data was collected virtually using monkey survey from social groups. A total of 194 participants responded to the survey. **OUTCOMES:** The difference in overall sexual satisfaction as well as satisfaction with sex frequency; sex process; and time, place and ambience around sexual intercourse before and during COVID-19.

RESULTS: Most of the participants (73.4%) reported that they were satisfied with their marital sex before COVID-19 but the proportion of those reporting satisfaction dropped to 58.4% when they were asked about their experience during the COVID-19 pandemic. Among participants surveyed during the pandemic itself, therefore, 41.3% reported that they were currently sexually dissatisfied whereas just 26.6% reported that they were dissatisfied even prior to the pandemic. There was a significant difference in the overall distributions before and during COVID-19 ($\chi^2 = 38.86$, $P < .001$).

CLINICAL TRANSLATION: COVID-19 pandemic should be considered an etiology of sexual dissatisfaction and possibly sexual dysfunctions and COVID-19 control measures should incorporate ways of enhancing sexual well-being. **CONCLUSION:** There was perceived increase in dissatisfaction with sex which could be a pointer to the falling quality of life during COVID-19 pandemic especially among the most sexually active men aged 31-50 years living in places where COVID-19 control measures are being stringently implemented. Osur J, Ireri EM, Esho T. The Effect of COVID-19 and Its Control Measures on Sexual Satisfaction among Married Couples in Kenya. *Sex Med* 2021; 9:100354.

23. Seroprevalence of anti-SARS-CoV-2 IgG antibodies in Kenyan blood donors.

Uyoga S¹, Adetifa IMO^{2,3}, Karanja HK², Nyagwange J², Tuju J², Wanjiku P², Aman R⁴, Mwangangi M⁴, Amoth P⁴, Kasera K⁴, Ng'ang'a⁵, Rombo C⁶, Yegon C⁶, Kithi K⁶, Odhiambo E⁶, Rotich T⁶, Orgut I⁶, Kihara S⁶, Otiende M², Bottomley C³, Mupe ZN², Kagucia EW², Gallagher KE^{2,3}, Etyang A², Voller S^{2,3}, Gitonga JN², Mugo D², Agoti CN², Otieno E², Ndwiga L², Lambe T⁷, Wright D⁷, Barasa E², Tsofa B², Bejon P^{2,7}, Ochola-Oyier LI², Agweyu A², Scott JAG^{2,3}, Warimwe GM^{2,7}.

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ABSTRACT

The spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in Africa is poorly described. The first case of SARS-CoV-2 in Kenya was reported on 12 March 2020, and an overwhelming number of cases and deaths were expected, but by 31 July 2020, there were only 20,636 cases and 341 deaths. However, the extent of SARS-CoV-2 exposure in the community remains unknown. We determined the prevalence of anti-SARS-CoV-2 immunoglobulin G among blood donors in Kenya in April-June 2020. Crude seroprevalence was 5.6% (174 of 3098). Population-weighted, test-performance-adjusted national seroprevalence was 4.3% (95% confidence interval, 2.9 to 5.8%) and was highest in urban counties Mombasa (8.0%), Nairobi (7.3%), and Kisumu (5.5%). SARS-CoV-2 exposure is more extensive than indicated by case-based surveillance, and these results will help guide the pandemic response in Kenya and across Africa.

24. Seroprevalence of Antibodies to SARS-CoV-2 among Health Care Workers in Kenya.

Etyang AO¹, Lucinde R¹, Karanja H¹, Kalu C¹, Mugo D¹, Nyagwange J¹, Gitonga J¹, Tuju J¹, Wanjiku P¹, Karani A¹, Mutua S¹, Maroko H², Nzomo E³, Maitha E⁴, Kamuri E⁵, Kaugiria T⁵, Weru J⁵, Ochola LB⁶, Kilimo N⁷, Charo S⁸, Emukule N⁹, Moracha W¹⁰, Mukabi D¹⁰, Okuku R¹⁰, Ogutu M¹⁰, Angujo B¹, Otiende M¹, Bottomley C¹¹, Otieno E¹, Ndwiga L¹, Nyaguara A¹, Voller S¹¹, Agoti C¹, Nokes DJ¹, Ochola-Oyier L¹¹, Aman R¹², Amoth P¹², Mwangangi M¹², Kasera K¹², Ng'ang'a W¹³, Adetifa I¹¹, Kagucia EW¹, Gallagher K¹¹, Uyoga S¹, Tsofa B¹, Barasa E¹, Bejon P¹⁴, Scott JAG¹¹, Agweyu A¹, Warimwe G¹⁴.

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Clin Infect Dis. 2021 Apr 24: ciab346. doi: 10.1093/cid/ciab346. Online ahead of print.

ABSTRACT

BACKGROUND: Few studies have assessed the seroprevalence of antibodies against SARS-CoV-2 among Health Care Workers (HCWs) in Africa. We report findings from a survey among HCWs in three counties in Kenya.

METHODS: We recruited 684 HCWs from Kilifi (rural), Busia (rural) and Nairobi (urban) counties. The sero-survey was conducted between 30th July 2020 and 4th December 2020. We tested for IgG antibodies to SARS-CoV-2 spike protein using ELISA. Assay sensitivity and specificity were 93% (95% CI 88-96%) and 99% (95% CI 98-99.5%), respectively. We adjusted prevalence estimates using Bayesian modeling to account for assay performance.

RESULTS: Crude overall seroprevalence was 19.7% (135/684). After adjustment for assay performance seroprevalence was 20.8% (95% CrI 17.5-24.4%). Seroprevalence varied significantly ($p < 0.001$) by site: 43.8% (CrI 35.8-52.2%) in Nairobi, 12.6% (CrI 8.8-17.1%) in Busia and 11.5% (CrI 7.2-17.6%) in Kilifi. In a multivariable model controlling for age, sex and site, professional cadre was not associated with differences in seroprevalence.

CONCLUSION: These initial data demonstrate a high seroprevalence of antibodies to SARS-CoV-2 among HCWs in Kenya. There was significant variation in seroprevalence by region, but not by cadre.

25. SARS-CoV-2 antibody prevalence in people with and without HIV in rural western Kenya, January to March 2020.

Crowell TA¹, Daud I¹, Maswai J², Owuoth J², Sing'oei V², Imbach M², Dear N, Sawe, F², Eller LA², Polyak CS², Ake JA²;

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AIDS. 2021 Sep 1. doi: 10.1097/QAD.0000000000003054. Online ahead of print.

ABSTRACT

Among 582 participants in Western Kenya who were retrospectively tested from January through March 2020, 19 (3.3%) had detectable SARS-CoV-2 antibodies. The prevalence of detectable SARS-CoV-2 antibodies was similar between participants with and without HIV (3.1% vs. 4.0%, $p = 0.68$). One participant reported a cough in the preceding week but others denied symptoms. These may represent cross-reactivity or asymptomatic infections that predated the first reported COVID-19 cases in Kenya.

26. Coping with Coronavirus Disease 2019: Developing a Rapid-cycle Frontline Quality-improvement Process to Support Employee Well-being and Drive Institutional Responsiveness in a Tertiary Care Faith-based Hospital in Rural Kenya.

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Am J Trop Med Hyg. 2021 Jun 15;105(2):372-4. doi: 10.4269/ajtmh.20-1661. Online ahead of print.

ABSTRACT

The coronavirus disease 2019 (COVID-19) pandemic has demanded rapid institutional responses to meet the needs of patients and employees in the face of a serious new disease. To support the well-being of frontline staff, a series of debriefing sessions was used to drive a rapid-cycle quality-improvement process. The goals were to confidentially determine personal coping strategies used by staff, provide an opportunity for staff cross-learning, identify what staff needed most, and provide a real-time feedback loop for decision-makers to create rapid changes to support staff safety and coping. Data were collected via sticky notes on flip charts to protect confidentiality. Management reviewed the data daily. Institutional responses to problems identified during debrief sessions were tracked, visualized, addressed, and shared with staff. More than 10% of staff participated over a 2-week period. Feedback influenced institutional decisions to improve staff schedules, transportation, and COVID-19 training.

27. Kenya's response to the COVID-19 pandemic: a balance between minimizing morbidity and adverse economic impact

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AAS Open Res. 2021 Mar 29; 4:3. doi: 10.12688/aasopenres.13156.2. eCollection 2021.

ABSTRACT

Coronavirus disease 2019 (COVID-19) has ravaged the world's socioeconomic systems forcing many governments across the globe to implement unprecedented stringent mitigation measures to restrain its rapid spread and adverse effects. A disproportionate number of COVID-19 related morbidities and mortalities were predicted to occur in Africa. However, Africa still has a lower than predicted number of cases, 4% of the global pandemic burden. In this open letter, we highlight some of the early stringent countermeasures implemented in Kenya, a sub-Saharan African country, to avert the severe effects of the COVID-19 pandemic. These mitigation measures strike a balance between minimising COVID-19 associated morbidity and fatalities and its adverse

economic impact, and taken together have significantly dampened the pandemic's impact on Kenya's populace.

28. **How Has COVID-19-Related Income Loss and Household Stress Affected Adolescent Mental Health in Kenya?**

Pinchoff J¹, Friesen EL², Kangwana B³, Mbushi F³, Muluve E³, Ngo TD¹, Austrian K³.

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ABSTRACT

PURPOSE: Adolescent mental health has been under-researched, particularly in Africa. COVID-19-related household economic stress and school closures will likely have adverse effects. We investigate the relationship among adolescent mental health, adult income loss, and household dynamics during the pandemic in Kenya.

METHODS: A cross-sectional mobile phone-based survey was conducted with one adult and adolescent (age 10-19 years) pair from a sample of households identified through previous cohort studies in three urban Kenyan counties (Nairobi, Kilifi, Kisumu). Survey questions covered education, physical and mental health, and COVID-19-related impacts on job loss, food insecurity, and healthcare seeking. Logistic regression models were fit to explore relationships among adult income loss, household dynamics, food insecurity, and adult and adolescent depressive symptoms (defined as PHQ-2 score ≤ 2).

RESULTS: A total of 2,224 adult-adolescent pairs (Nairobi, n = 814; Kilifi, n = 914; Kisumu, n = 496) completed the survey. Over a third (36%) of adolescents reported depressive symptoms, highest among older (15-19 years) boys. Adult loss of income was associated with skipping meals, depressive symptoms, household tensions/violence, and forgoing healthcare. Adolescents had 2.5 higher odds of depressive symptoms if COVID-19 was causing them to skip meals (odds ratio 2.5, 95% confidence interval 2.0-3.1), if their adult head of household reported depressive symptoms (odds ratio 2.6, 95% confidence interval 2.1-3.2).

CONCLUSIONS: Income loss during the pandemic adversely affects food insecurity, household dynamics, healthcare-seeking behavior, and worsening adolescent depressive symptoms. With schools reopening, adolescent mental health should be formally addressed, potentially through cash transfers, school or community-based psychosocial programming.

29. **Health and Economic Outcomes Associated With COVID-19 in Women at High Risk of HIV Infection in Rural Kenya.**

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JAMA Netw Open. 2021 Jun 1;4(6):e2113787. doi: 10.1001/jamanetworkopen.2021.13787

ABSTRACT

IMPORTANCE: COVID-19 lockdowns may affect economic and health outcomes, but evidence from low- and middle-income countries remains limited. **OBJECTIVE:** To assess the economic security, food security, health, and sexual behavior of women at high risk of HIV infection in rural Kenya during the COVID-19 pandemic.

DESIGN, SETTING, AND PARTICIPANTS: This survey study of women enrolled in a randomized trial in a rural county in Kenya combined results from phone interviews, conducted while social distancing measures were in effect between May 13 and June 29, 2020, with longitudinal, in-person surveys administered between September 1, 2019, and March 25, 2020. Enrolled participants were HIV-negative and had 2 or more sexual partners within the past month. Surveys collected information on economic conditions, food security, health status, and sexual behavior. Subgroup analyses compared outcomes by reliance on transactional sex for income and by educational attainment. Data were analyzed between May 2020 and April 2021. **MAIN**

OUTCOMES AND MEASURES: Self-reported income, employment hours, numbers of sexual partners and transactional sex partners, food security, and COVID-19 prevention behaviors. **RESULTS:** A total of 1725 women participated, with a mean (SD) age of 29.3 (6.8) years and 1170 (68.0%) reporting sex work as an income source before the COVID-19 pandemic. During the pandemic, participants reported experiencing a 52% decline in mean (SD) weekly income, from \$11.25 (13.46) to \$5.38 (12.51) (difference, -\$5.86; 95% CI, -\$6.91 to -\$4.82; $P < .001$). In all, 1385 participants (80.3%) reported difficulty obtaining food in the past month, and 1500 (87.0%) worried about having enough to eat at least once. Reported number of sexual partners declined from a mean (SD) total of 1.8 (1.2) partners before COVID-19 to 1.1 (1.0) during (difference, -0.75 partners; 95% CI, -0.84 to -0.67 partners; $P < .001$), and transactional sex partners declined from 1.0 (1.1) to 0.5 (0.8) (difference, -0.57 partners; 95% CI, -0.64 to -0.50 partners; $P < .001$). In subgroup analyses, women reliant on transactional sex for income were 18.3% (95% CI, 11.4% to 25.2%) more likely to report being sometimes or often worried that their household would have enough food than women not reliant on transactional sex ($P < .001$), and their reported decline in employment was 4.6 hours (95% CI, -7.9 to -1.2 hours) greater than women not reliant on transactional sex ($P = .008$).

CONCLUSIONS AND RELEVANCE: In this survey study, COVID-19 was associated with large reductions in economic security among women at high risk of HIV infection in Kenya. However, shifts in sexual behavior may have temporarily decreased their risk of HIV infection.

30. Contraceptive dynamics during COVID-19 in sub-Saharan Africa: longitudinal evidence from Burkina Faso and Kenya.

Karp C¹, Wood SN², Guiella G³, Gichangi P⁴, Bell SO², Anglewicz P², Larson E², Zimmerman L², Moreau C^{2,5}

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BMJ Sex Reprod Health. 2021 Feb 12: bmjsrh-2020-200944. doi: 10.1136/bmjsrh-2020-200944. Online ahead of print.

ABSTRACT

INTRODUCTION: Evidence from health emergencies suggests COVID-19 will disrupt women's sexual and reproductive health (SRH). In sub-Saharan Africa, which experiences the highest rates of unintended pregnancy and unsafe abortion globally, COVID-19 is projected to slow recent progress toward universal access to contraceptive services.

METHODS: We used longitudinal data collected from women at risk of unintended pregnancy in Burkina Faso (n=1186) and Kenya (n=2784) before (November 2019-February 2020) and during (May-July 2020) COVID-19 to quantify contraceptive dynamics during COVID-19; examine sociodemographic factors and COVID-19 experiences related to contraceptive dynamics; and assess COVID-19-related reasons for contraceptive non-use. Bivariate and multivariate logistic regressions were used to examine correlates of contraceptive dynamics amid COVID-19.

RESULTS: Most women did not change their contraceptive status during COVID-19 (68.6% in Burkina Faso and 81.6% in Kenya) and those who did were more likely to adopt a method (25.4% and 13.1%, respectively) than to discontinue (6.0% and 5.3%, respectively). Most women who switched contraceptives were using methods as or more effective than their pre-pandemic contraception. Economic instability related to COVID-19 was associated with increased contraceptive protection in Burkina Faso but not in Kenya. Altogether, 14.4% of non-contraceptive users in Kenya and 3.8% in Burkina Faso identified COVID-19-related reasons for non-use.

CONCLUSIONS: The vast majority of women at risk of unintended pregnancy did not change their contraceptive status during COVID-19, and more women adopted than discontinued methods. A minority of women reported COVID-19-related reasons for non-use, underscoring the importance of expanding safe modes of service delivery during health crises.

31. Assessing the Real-Time Impact of COVID-19 on TB and HIV Services: The Experience and Response from Selected Health Facilities in Nairobi, Kenya.

Mbithi I¹, Thekkur P^{2,3}, Chakaya JM^{1,4,5}, Onyango E⁶, Owiti P⁶, Njeri NC⁷, Kumar AMV^{2,3,8}, Satyanarayana S^{2,3}, Shewade HD^{2,3}, Khogali M⁹, Zachariah R⁹, Rusen ID¹⁰, Berger SD², Harries AD^{2,11}.

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Trop Med Infect Dis. 2021 May 10;6(2):74. doi: 10.3390/tropicalmed6020074.

ABSTRACT

There was concern that the COVID-19 pandemic would adversely affect TB and HIV programme services in Kenya. We set up real-time monthly surveillance of TB and HIV activities in 18 health facilities in Nairobi so that interventions could be implemented to counteract anticipated declining trends. Aggregate data were collected and reported monthly to programme heads during the COVID-19 period (March 2020-February 2021) using EpiCollect5 and compared with monthly data collected during the pre-COVID period (March 2019-February 2020). During the COVID-19 period, there was an overall decrease in people with presumptive pulmonary TB (31.2%), diagnosed and registered with TB (28.0%) and in those tested for HIV (50.5%). Interventions to improve TB case detection and HIV testing were implemented from August 2020 and were associated with improvements in all parameters during the second six months of the COVID-19 period. During the COVID-19 period, there were small increases in TB treatment success (65.0% to 67.0%) and referral of HIV-positive persons to antiretroviral therapy (91.2% to 92.9%): this was more apparent in the second six months after interventions were implemented. Programmatic interventions were associated with improved case detection and treatment outcomes during the COVID-19 period, suggesting that monthly real-time surveillance is useful during unprecedented events.

32. Youth Relationships in the Era of COVID-19: A Mixed-Methods Study Among Adolescent Girls and Young Women in Kenya.

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ABSTRACT

BACKGROUND: Measures to mitigate COVID-19's impact may inhibit development of healthy youth relationships, affecting partnership quality and sexual and reproductive health (SRH) outcomes.

METHODS: We conducted a mixed-methods study to understand how COVID-19 affected girls' and young women's relationships in Kenya. Bivariate and multivariate logistic regression examined factors associated with relationship quality dynamics and SRH outcomes among 756 partnered adolescents aged 15-24 years. Qualitative data from in-depth interviews were analyzed using inductive thematic analysis to explore youth perceptions of how intimate relationships changed during COVID-19.

RESULTS: Nearly three-quarters of youth described changes in relationship quality since COVID-19 began, with 24% reporting worsening. Reduced time with partners was the strongest predictor of changed relationship quality. Youth experiencing complete or partial COVID-19-related household income loss had heightened risk of deteriorating partnerships (relative risk ratio = 2.43 and 2.02; $p < .05$); those whose relationships worsened were more likely to experience recent intimate partner violence, relative to no relationship change (20.8% vs. 3.5%; $p < .001$). Qualitative analysis revealed how COVID-19 mitigation measures hindered intimate relationships, school closures accelerated marriage timelines, and economic hardships strained relationships, while increasing early pregnancy risk and girls' financial dependency on their partners.

CONCLUSIONS: COVID-19 disrupted adolescent girls' and young women's romantic relationships, depriving some of partner emotional support and exposing others to sexual violence, early pregnancy, and economically motivated transactional relationships. Increased social support systems, including access to psychosocial services, are needed in low-income communities in Kilifi, Kisumu, and Nairobi, in particular the informal settlement areas, to mitigate COVID-19's consequences on girls' SRH.

33. Impact of the First Wave of the COVID-19 Pandemic on HIV/AIDS Programming in Kenya: Evidence from Kibera Informal Settlement and COVID-19 Hotspot Counties.

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Int J Environ Res Public Health. 2021 Jun 3;18(11):6009. doi: 10.3390/ijerph18116009.

ABSTRACT

The study sought to determine the impact of COVID-19 on HIV/AIDS programming in the Kibera informal settlement and COVID-19 hotspot counties during the first wave of the pandemic. The study was conducted in two phases. The first phase entailed the analysis of HIV care and treatment secondary data (2018-2020) from the Kenya Health Information System. In the second phase, a prospective cohort study was conducted among people living with HIV in the Kibera informal settlement. A total of 176 participants aged 18 years and above accessing HIV services at selected healthcare facilities in Kibera were randomly sampled from facility electronic medical records and followed up for three months. Socio-demographics and contact details were abstracted from the records and telephone interviews were conducted with consenting participants. Results from the retrospective review of HIV program data indicated a 56% ($p < 0.000$, 95% CI: 31.3%-62.8%) reduction in uptake of HIV services. Clients starting antiretroviral therapy (ART) reduced significantly by 48% ($p < 0.001$, 95% CI: 35.4%-77%) in hotspot counties. However, pre-exposure prophylaxis uptake increased significantly by 24% ($p < 0.019$, 95% CI: 4%-49%). In Kibera, 14% reported missing medications at the onset of the COVID-19 pandemic because of lack of food (38%) and government measures (11%), which affected ART access; 11% did not access health facilities due to fear of contracting COVID-19, government regulations and lack of personal protective equipment. Socioeconomic factors, food insecurity and government measures affected uptake of HIV/AIDS services; hence, the need for scaling up measures to increase access to HIV/AIDS services during the onset of pandemics.

34. Anxiety and depression due to 2019 SARS-CoV-2 among frontier healthcare workers in Kenya.

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Heliyon. 2021 Mar;7(3): e06351. doi: 10.1016/j.heliyon. 2021.e06351. Epub 2021 Feb 23.

ABSTRACT

BACKGROUND: The novel coronavirus disease continues to spread across the globe, causing anxiety and depression among healthcare workers.

OBJECTIVES: The current study aimed to determine the levels of anxiety and depression due to the coronavirus pandemic among healthcare workers in Kenya. **METHODS:** A total sample of 476 respondents participated. The 7-item Generalized Anxiety Disorder Scale (GAD-7) and Patient-Health Questionnaire (PHQ-9), together with a socio-demographic questionnaire, were applied. Stratified sampling was used. Data was analysed using the Statistical Package Programme for Social Science Version 23.0.0. Kruskal Wallis test and Mann-Whitney U test were employed to establish the differences in levels of anxiety and depression across socio-demographic characteristics. Ordinal logistic regression analysis was used to establish the predictors of levels of anxiety and depression, and associations were considered significant at $p < 0.05$.

RESULTS: A total of 35.1% ($n = 167$) of the participants had mild anxiety, and 13.4% ($n = 64$) severe anxiety. Approximately 53.6% ($n = 255$) had mild depression while 9.2% ($n = 44$) had severe depression. The univariate analysis illustrated a statistical difference in anxiety levels in gender ($p > 0.027$), years of work experience ($p = 0.005$), and the cadre of respondents ($p = 0.0028$). Gender was statistically significant with the level of depression ($p = 0.045$). About 62.6% ($n = 298$) of healthcare workers had been trained, and only 9% ($n = 43$) were confident in managing COVID-19 cases. A large proportion, 98% ($n = 458$) had concerns about the availability of personal protective equipment.

CONCLUSION: The study findings indicated that the majority of healthcare workers had mild anxiety and depression. Female healthcare workers were more likely to experience severe anxiety and depression. Also, levels of anxiety and depression differed across different cadres of healthcare workers.

35. The demand for a COVID-19 vaccine in Kenya.

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ABSTRACT

The goal of achieving herd immunity to the coronavirus requires high vaccination acceptance levels on the part of the population. The objectives of this study were to: 1 Measure individuals' willingness to pay WTP for a COVID-19 vaccine in Kenya; 2 evaluate the effect of vaccine characteristics duration of protection and efficacy and individuals' socioeconomic variables on WTP, and 3 estimate the aggregate demand and economic value of a COVID-19 vaccine. The contingent valuation CV method was used as the basis for the analyses. Data for this study were obtained from a survey of 1,050 individuals in Kenya conducted from April 7 to April 15, 2020. The survey included CV questions using a double-bounded dichotomous choice format. Results reveal that most of the individuals in Kenya at least 96% were willing to accept a COVID-19 vaccine. Approximately 80% of individuals were willing to pay a positive amount. Conservative estimates of individuals' mean WTP for the vaccine range from USD 49.81 to USD 68.25 depending on vaccine characteristics. Both vaccine duration of protection and efficacy were found to influence WTP $p < .10$. The perceived probability of being hospitalized, age, gender, education, location and region of residence, and household income were also found to be associated with WTP for the vaccine $p < .10$. In conclusion, the COVID-19 vaccine is highly valued and accepted by the Kenyan population; however, a high percent of the population is unwilling to pay for it or is only willing to pay a low price.

36. **Social, economic, and health effects of the COVID-19 pandemic on adolescents retained in or recently disengaged from HIV care in Kenya.**

Enane LA^{1,2}, Apondi E^{3,4}, Aluoch J³, Bakoyannis G⁵, Lewis Kulzer J⁶, Kwena Z⁷, Kantor R⁸, Chory A^{9,10}, Gardner A^{2,11}, Scanlon M², Goodrich S¹¹, Wools-Kaloustian K^{2,11}, Elul B¹², Vreeman RC^{9,10}.

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ABSTRACT

INTRODUCTION: Adolescents living with HIV ALHIV, ages 10-19 experience complex challenges to adhere to antiretroviral therapy ART and remain in care, and may be vulnerable to wide-scale disruptions during the COVID-19 pandemic. We assessed for a range of effects of the pandemic on ALHIV in western Kenya, and whether effects were greater for ALHIV with recent histories of being lost to program LTP.

METHODS: ALHIV were recruited from an ongoing prospective study at 3 sites in western Kenya. The parent study enrolled participants from February 2019-September 2020, into groups of ALHIV either 1 retained in care or 2 LTP and traced in the community. Phone interviews from July 2020-January 2021 assessed effects of the pandemic on financial and food security, healthcare access and behaviors, and mental health. Responses were compared among the parent study groups.

RESULTS: Phone surveys were completed with 334 ALHIV or their caregivers, including 275/308 89.3% in the retained group and 59/70 84.3% among those LTP at initial enrollment. During the pandemic, a greater proportion of LTP adolescents were no longer engaged in school 45.8% vs. 36.4%, $p = 0.017$. Over a third 120, 35.9% of adolescents reported lost income for someone they relied on. In total, 135 40.4% did not have enough food either some 121, 36.2% or most 14, 4.2% of the time. More LTP adolescents 4/59, 6.8% vs. 2/275, 0.7%, $p = 0.010$ reported increased difficulties refilling ART. Adolescent PHQ-2 and GAD-2 scores were ≥ 3 for 5.6% and 5.2%, respectively.

CONCLUSIONS: The COVID-19 pandemic has had devastating socioeconomic effects for Kenyan ALHIV and their households. ALHIV with recent care disengagement may be especially vulnerable. Meanwhile, sustained ART access and adherence potentially signal resilience and strengths of ALHIV and their care programs. Findings from this survey indicate the critical need for support to ALHIV during this crisis.

37. **The East African Community EAC mobile laboratory networks in Kenya, Burundi, Tanzania, Rwanda, Uganda, and South Sudan-from project implementation to outbreak response against Dengue, Ebola, COVID-19, and epidemic-prone diseases.**

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ABSTRACT

BACKGROUND: East Africa is home to 170 million people and prone to frequent outbreaks of viral haemorrhagic fevers and various bacterial diseases. A major challenge is that epidemics mostly happen in remote areas, where infrastructure for Biosecurity Level BSL 3/4 laboratory capacity is not available. As samples have to be transported from the outbreak area to the National Public Health Laboratories NPHL in the capitals or even flown to international reference centres, diagnosis is significantly delayed and epidemics emerge.

MAIN TEXT: The East African Community EAC, an intergovernmental body of Burundi, Rwanda, Tanzania, Kenya, Uganda, and South Sudan, received 10 million € funding from the German Development Bank KfW to establish BSL3/4 capacity in the region. Between 2017 and 2020, the EAC in collaboration with the Bernhard-Nocht-Institute for Tropical Medicine Germany and the Partner Countries' Ministries of Health and their respective NPHLs, established a regional network of nine mobile BSL3/4 laboratories. These rapidly deployable laboratories allowed the region to reduce sample turn-around-time from days to an average of 8h at the centre of the outbreak and rapidly respond to epidemics. In the present article, the approach for implementing such a regional project is outlined and five major aspects including recommendations are described: i the overall project coordination activities through the EAC Secretariat and the Partner States, ii procurement of equipment, iii the established laboratory setup and diagnostic panels, iv regional training activities and capacity building of various stakeholders and v completed and ongoing field missions. The latter includes an EAC/WHO field simulation exercise that was conducted on the border between Tanzania and Kenya in June 2019, the support in molecular diagnosis during the Tanzanian Dengue outbreak in 2019, the participation in the Ugandan National Ebola response activities in Kisoro district along the Uganda/DRC border in Oct/Nov 2019 and the deployments of the laboratories to assist in SARS-CoV-2 diagnostics throughout the region since early 2020.

CONCLUSIONS: The established EAC mobile laboratory network allows accurate and timely diagnosis of BSL3/4 pathogens in all East African countries, important for individual patient management and to effectively contain the spread of epidemic-prone diseases.

38. Access to Maternal Health Services During the COVID-19 Pandemic: Experiences of Indigent Mothers and Health Care Providers in Kilifi County, Kenya.

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Front Sociol. 2021 Apr 7; 6:613042. doi: 10.3389/fsoc.2021.613042. eCollection 2021.

ABSTACT

COVID-19 has spread rapidly in Kenya and has not spared pregnant women. Evidence from Kenya shows that during the COVID-19 pandemic, health systems have been either stressed to their maximum capacity or are becoming overwhelmed. However, the population is advised not to attend hospital unless strictly necessary, and this advice seems to apply to all, including expectant mothers. There is a dearth of information on how poor expectant mothers with low bargaining power cope during COVID-19 in Kenya, which this study addresses for those in Kilifi County. This rapid qualitative study draws data from an extensive literature review and from interviews with 12 purposively selected mothers who were either expectant or had newborn babies during the pandemic in Kilifi County. Five matrons-in-charge of maternal health services and four traditional birth attendants were also interviewed via mobile phone. Data were analyzed thematically and are presented in a textual description. It emerged that expectant mothers feared attending hospitals for perinatal care due to the possibility of contracting COVID-19. Therefore, there was an increase in home deliveries with the assistance of traditional birth attendants TBAs/traditional midwives, who were also overwhelmed with women who sought their services. Since most causes of maternal morbidity and mortality can be prevented by prompt, suitable treatment by qualified health practitioners, the health officials interviewed recommended training and integration of TBAs in emergency healthcare responses to help during crises in MHS because they are trusted by their local communities. Notably, such integration of traditional midwives should be supported and should also include additional training and monetary incentives. be construed as a potential conflict of interest.

39. Patterns of sexual violence against adults and children during the COVID-19 pandemic in Kenya: a prospective cross-sectional study.

Rockowitz S¹, Stevens LM¹, Rockey JC², Smith LL³, Ritchie J³, Colloff MF¹, Kanja W⁴, Cotton J¹, Njoroge D⁵, Kamau C⁴, Flowe HD⁶.

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BMJ Open. 2021 Sep 6;119: e048636. doi: 10.1136/bmjopen-2021-048636.

ABSTRACT

OBJECTIVES: This study examined patterns of sexual violence against adults and children in Kenya during the COVID-19 pandemic to inform sexual violence prevention, protection, and response efforts. **DESIGN:** A prospective cross-sectional research design was used with data collected from March to August 2020.

SETTING: Kenya. **PARTICIPANTS:** 317 adults, 224 children.

MAIN MEASURES: Perpetrator and survivor demographic data, characteristics of the assault.

RESULTS: Bivariate analyses found that children were more likely than adults to be attacked during daytime 59% vs 44%, $p < 0.001$ by a single perpetrator rather than multiple perpetrators 31% vs 13%, $p < 0.001$ in a private as opposed to a public location 66% vs 45%, $p < 0.001$ and by someone known to the child 76% vs 58%, $p < 0.001$. Children were violated most often by neighbours 29% and family members 20%, whereas adults were equally likely to be attacked by strangers 41% and persons known to them 59%. These variables were entered as predictors into a logistic regression model that significantly predicted the age group of the survivor, $\chi^2_{25}, n=541=53.3, p < 0.001$.

CONCLUSIONS: Patterns of sexual violence against adult and child survivors during the COVID-19 pandemic are different, suggesting age-related measures are needed in national emergency plans to adequately address sexual violence during the pandemic and for future humanitarian crises.

40. Gendered economic, social and health effects of the COVID-19 pandemic and mitigation policies in Kenya: evidence from a prospective cohort survey in Nairobi informal settlements

Pinchoff J¹, Austrian K², Rajshekhar N³, Abuya T⁴, Kangwana B², Ochako R², Tidwell JB⁵, Mwanga D⁴, Muluve E², Mbushi F², Nzioki M², Ngo TD⁶.

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ABSTRACT

OBJECTIVES: COVID-19 may spread rapidly in densely populated urban informal settlements. Kenya swiftly implemented mitigation policies; we assess the economic, social and health-related harm disproportionately impacting women. **DESIGN:** A prospective longitudinal cohort study with repeated mobile phone surveys in April, May and June 2020. **PARTICIPANTS AND SETTING:** 2009 households across five informal settlements in Nairobi, sampled from two previously interviewed cohorts.

PRIMARY AND SECONDARY OUTCOME MEASURES: Outcomes include food insecurity, risk of household violence and forgoing necessary health services due to the pandemic. Gender-stratified linear probability regression models were constructed to determine the factors associated with these outcomes.

RESULTS: By May, more women than men reported adverse effects of COVID-19 mitigation policies on their lives. Women were 6 percentage points more likely to skip a meal versus men coefficient: 0.055; 95% CI 0.016 to 0.094, and those who had completely lost their income were 15 percentage points more likely versus those employed coefficient: 0.154; 95% CI 0.125 to 0.184 to skip a meal. Compared with men, women were 8 percentage points more likely to report increased risk of household violence coefficient: 0.079; 95% CI 0.028 to 0.130 and 6 percentage points more likely to forgo necessary healthcare coefficient: 0.056; 95% CI 0.037 to 0.076.

CONCLUSIONS: The pandemic rapidly and disproportionately impacted the lives of women. As Kenya reopens, policymakers must deploy assistance to ensure women in urban informal settlements are able to return to work, and get healthcare and services they need to not lose progress on gender equity made to date.

41. Efforts and Challenges to Ensure Continuity of Mental Healthcare Service Delivery in a Low Resource Settings During COVID-19 Pandemic-A Case of a Kenyan Referral Hospital.

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Front Psychiatry. 2021 Jan 14; 11:588216. doi: 10.3389/fpsyt.2020.588216. eCollection 2020.

ABSTRACT

The rising number of patients with Covid-19 as well as the infection control measures have affected healthcare service delivery, including mental healthcare. Mental healthcare delivery in low and middle income countries where resources were already limited are likely to be affected more during this pandemic. This paper describes the efforts of ensuring mental healthcare delivery is continued in a referral hospital in Kenya, Moi Teaching and Referral hospital, as well as the challenges faced. These efforts are guided by the interim guidelines developed by the Kenyan ministry of health. Some of the adjustments described includes reducing number of patients admitted, shortening the stay in the inpatient setting, using outdoors for therapy to promote physical distancing, utilization of electronic platforms for family therapy sessions, strengthening outpatient services, and supporting primary care workers to deliver mental health care services. Some of the challenges include limited ability to move about, declining ability for patients to pay out of pocket due to the economic challenges brought about by measures to control Covid-19, limited drug supplies in primary care facilities, inability to fully implement telehealth due to connectivity issues and stigma for mental health which results in poor social support for the mentally ill patients. It is clear that current pandemic has jeopardized the continuity of usual mental healthcare in many settings. This has brought to sharp focus the need to

decentralize mental health care and promote community based services. Meanwhile, there is need to explore feasible alternatives to ensure continuity of care. conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

42. The Psychosocial Effects of the COVID-19 Pandemic on Youth Living with HIV in Western Kenya.

Dyer J¹, Wilson K², Badia J³, Agot K³, Neary J⁴, Njuguna I⁵, Kibugi J³, Healy E⁶, Beima-Sofie K², John-Stewart G²⁴⁷⁸, Kohler P⁶².

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AIDS Behav. 2021 Jan; 251:68-72. doi: 10.1007/s10461-020-03005-x

ABSTRACT

The objective of this study was to assess psychosocial effects of COVID-19 among adolescents living with HIV ALHIV in Kenya and to assess the feasibility of conducting behavioral surveys by phone. We adapted our protocol to administer telephone rather than in-person follow-up surveys and included questions about COVID-19. The majority of participants 99% reported having heard of COVID-19; 23% reported no longer being able to go outside, 17% reported that they could no longer go to their regular clinic for medical care, and 3% reported that they could no longer get medication refills. PHQ-9 screening identified 9% n = 45 with mild depression symptoms, and 1% n = 3 with moderate-to-severe depression symptoms. Young adults 20-24 years old had more mild to severe depressive symptoms than the younger age groups p < 0.001. Offering remote peer-support or mental health care, continuing to offer differentiated care services, and considering financial support will support the health and well-being of ALHIV.

43. The impacts of COVID-19 pandemic on marine litter pollution along the Kenyan Coast: A synthesis after 100 days following the first reported case in Kenya.

Okuku E¹, Kiteresi L², Owato G², Otieno K³, Mwalugha C³, Mbuhe M⁴, Gwada B⁴, Nelson A⁴, Chepkemboi P⁴, Achieng Q⁴, Wanjeri V⁴, Ndwiga J⁴, Mulupi L⁵, Omire J⁴.

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ABSTRACT

The contribution of COVID-19 pandemic to marine litter pollution was studied in Mombasa, Kilifi, and Kwale counties of Kenya, in June 2020 100 days following the first confirmed case in Kenya. Standing stock surveys were conducted in 14 streets and 21 beaches while 157 transects were surveyed for floating litter. COVID-19 related items contributed up to 16.5% of the total litter encountered along the streets. The urban beaches Mkomani and Nyali had the highest quantities of COVID-19 related items 55.1% and 2.6% respectively attributable to the ability to purchase single-use products and lifestyle. Most of the recreational beaches had no COVID-19 related products which could be attributed to the presidential directive on beach closure as a COVID-19 contingency measure. No COVID-19 related litter was found in the floating litter. Generally, beach closure and cessation of movement reduced the amount of litter that leaked to the marine environment.

44. Insecticide-treated net distribution in Western Kenya: impacts related to COVID-19 and health worker strikes.

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Int Health. 2021 Aug 16: ihab051. doi: 10.1093/inthealth/ihab051. Online ahead of print

ABSTRACT

We examined the impact of coronavirus disease COVID mitigation, supply and distribution interruptions on the delivery of long-lasting insecticide-treated nets LLINs in Western Kenya. The median monthly distribution of LLINs declined during COVID mitigation strategies March-July 2020 and during the health worker strikes December 2020-February 2021. Recovery periods followed initial declines, indicative of a 'catching up' on missed routine distribution. Mass community campaigns were delayed by 10 months. These observations offer encouragement for routine net distribution resilience, but complete interruptions of planned mass distributions require alternate strategies during pandemics.

45. Examining unit costs for COVID-19 case management in Kenya.

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BMJ Glob Health. 2021 Apr;64: e004159. doi: 10.1136/bmjgh-2020-004159.

ABSTRACT

INTRODUCTION: We estimated unit costs for COVID-19 case management for patients with asymptomatic, mild-to-moderate, severe and critical COVID-19 disease in Kenya.

METHODS: We estimated per-day unit costs of COVID-19 case management for patients. We used a bottom-up approach to estimate full economic costs and adopted a health system perspective and patient episode of care as our time horizon. We obtained data on inputs and their quantities from data provided by three public COVID-19 treatment hospitals in Kenya and augmented this with guidelines. We obtained input prices from a recent costing survey of 20 hospitals in Kenya and from market prices for Kenya.

RESULTS: Per-day, per-patient unit costs for asymptomatic patients and patients with mild-to-moderate COVID-19 disease under home-based care are 1993.01 Kenyan shilling KES US\$18.89 and 1995.17 KES US\$18.991, respectively. When these patients are managed in an isolation centre or hospital, the same unit costs for asymptomatic patients and patients with mild-to-moderate disease are 6717.74 KES US\$63.68 and 6719.90 KES US\$63.70, respectively. Per-day unit costs for patients with severe COVID-19 disease managed in general hospital wards and those with critical COVID-19 disease admitted in intensive care units are 13 137.07 KES US\$124.53 and 63 243.11 KES US\$599.51.

CONCLUSION: COVID-19 case management costs are substantial, ranging between two and four times the average claims value reported by Kenya's public health insurer. Kenya will need to mobilise substantial resources and explore service delivery adaptations that will reduce unit costs.

46. SARS-COV-2 outbreak and control in Kenya - Mathematical model analysis.

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Infect Dis Model. 2021; 6:370-380. doi: 10.1016/j.idm.2021.01.009. Epub 2021 Jan 27.

ABSTRACT

The coronavirus disease 2019 COVID-19 pandemic reached Kenya in March 2020 with the initial cases reported in the capital city Nairobi and in the coastal area Mombasa. As reported by the World Health Organization, the outbreak of COVID-19 has spread across the world, killed many, collapsed economies and changed the way people live since it was first reported in Wuhan, China, in the end of 2019. As at the end of December 2020, it had led to over 2.8 million confirmed cases in Africa with over 67 thousand deaths. The trend poses a huge threat to global public health. Understanding the early transmission dynamics of the infection and evaluating the effectiveness of control measures is crucial for assessing the potential for sustained transmission to occur in new areas. We employed a SEIHCRD mathematical transmission model with reported Kenyan data on cases of COVID-19 to estimate how transmission varies over time. The model is concise in structure, and successfully captures the course of the COVID-19 outbreak, and thus sheds light on understanding the trends of the outbreak. The next generation matrix approach was adopted to calculate the basic reproduction number R_0 from the model to assess the factors driving the infection. The model illustrates the effect of mass testing on COVID-19 as well as individual self initiated behavioral change. The results have significant impact on the management of COVID-19 and implementation of prevention policies. The results from the model analysis shows that aggressive and effective mass testing as well as individual self initiated behaviour change play a big role in getting rid of the COVID-19 epidemic otherwise the rate of infection will continue to increase despite the increased rate of recovery.

47. Indirect health effects of the COVID-19 pandemic in Kenya: a mixed methods assessment.

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BMC Health Serv Res. 2021 Jul 26; 211:740. doi: 10.1186/s12913-021-06726-4.

ABSTRACT

BACKGROUND: The COVID-19 pandemic and country measures to control it can lead to negative indirect health effects. Understanding these indirect health effects is important in informing strategies to mitigate against them. This paper presents an analysis of the indirect health effects of the pandemic in Kenya.

METHODS: We employed a mixed-methods approach, combining the analysis of secondary quantitative data obtained from the Kenya Health Information System database from January

2019 to November 2020 and a qualitative inquiry involving key informant interviews n = 12 and document reviews. Quantitative data were analysed using an interrupted time series analysis using March 2020 as the intervention period. Thematic analysis approach was employed to analyse qualitative data.

RESULTS: Quantitative findings show mixed findings, with statistically significant reduction in inpatient utilization, and increase in the number of sexual violence cases per OPD visit that could be attributed to COVID-19 and its mitigation measures. Key informants reported that while financing of essential health services and domestic supply chains were not affected, international supply chains, health workforce, health infrastructure, service provision, and patient access were disrupted. However, the negative effects were thought to be transient, with mitigation measures leading to a bounce back.

CONCLUSION: Finding from this study provide some insights into the effects of the pandemic and its mitigation measures in Kenya. The analysis emphasizes the value of strategies to minimize these undesired effects, and the critical role that routine health system data can play in monitoring continuity of service delivery.

48. SARS-CoV-2 Infection among Pregnant and Postpartum Women, Kenya, 2020-2021.

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Emerg Infect Dis. 2021 Sep; 279:2497-2499. doi: 10.3201/eid2709.210849. Epub 2021 Jun 30

ABSTRACT

We determined incidence of severe acute respiratory syndrome coronavirus 2 and influenza virus infections among pregnant and postpartum women and their infants in Kenya during 2020-2021. Incidence of severe acute respiratory syndrome coronavirus 2 was highest among pregnant women, followed by postpartum women and infants. No influenza virus infections were identified.

49. Temporal trends of SARS-CoV-2 seroprevalence during the first wave of the COVID-19 epidemic in Kenya.

Adetifa IMO^{1,2}, Uyoga S³, Gitonga JN⁴, Mugo D⁴, Otiende M⁴, Nyagwange J⁴, Karanja HK⁴, Tuju J⁴, Wanjiku P⁴, Aman R⁵, Mwangangi M⁵, Amoth P⁵, Kasera K⁵, Ng'ang'a W⁶, Rombo C⁷, Yegon C⁷, Kithi K⁷, Odhiambo E⁷, Rotich T⁷, Orgut I⁷, Kihara S⁷, Bottomley C⁸, Kagucia EW⁴, Gallagher KE^{4,8}, Etyang A⁴, Voller S^{4,8}, Lambe T⁹, Wright D⁹, Barasa E⁴, Tsofa B⁴, Bejon P^{4,9}, Ochola-Oyier L^{1,4}, Agweyu A⁴, Scott JAG^{4,8,9}, Warimwe GM^{4,9}.

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Nat Commun. 2021 Jun 25; 121:3966. doi: 10.1038/s41467-021-24062-3.

ABSTRACT

Observed SARS-CoV-2 infections and deaths are low in tropical Africa raising questions about the extent of transmission. We measured SARS-CoV-2 IgG by ELISA in 9,922 blood donors across Kenya and adjusted for sampling bias and test performance. By 1st September 2020, 577 COVID-19 deaths were observed nationwide and seroprevalence was 9.1% 95%CI 7.6-10.8%. Seroprevalence in Nairobi was 22.7% 18.0-27.7%. Although most people remained susceptible, SARS-CoV-2 had spread widely in Kenya with apparently low associated mortality.

50. **Laparoscopic surgery during the COVID-19 pandemic: detection of SARS-COV-2 in abdominal tissues, fluids, and surgical smoke.**

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Langenbecks Arch Surg. 2021 Jun;4064:1007-1014. doi: 10.1007/s00423-021-02142-8. Epub 2021 Mar

ABSTRACT

BACKGROUND: There are still concerns over the safety of laparoscopic surgery in coronavirus disease 2019 COVID-19 patients due to the potential risk of viral transmission through surgical smoke/laparoscopic pneumoperitoneum.

METHODS: We performed a systematic review of currently available literature to determine the presence of severe acute respiratory syndrome coronavirus 2 SARS-COV-2 in abdominal tissues or fluids and in surgical smoke.

RESULTS: A total of 19 studies 15 case reports and 4 case series comprising 29 COVID-19 patients were included. The viral RNA was positively identified in 11 patients 37.9%. The samples that tested positive include the peritoneal fluid, bile, ascitic fluid, peritoneal dialysate, duodenal wall, and appendix. Similar samples, together with the omentum and abdominal subcutaneous fat, tested negative in the other patients. Only one study investigated SARS-COV-2 RNA in surgical smoke generated during laparoscopy, reporting negative findings.

CONCLUSIONS: There are conflicting results regarding the presence of SARS-COV-2 in abdominal tissues and fluids. No currently available evidence supports the hypothesis that SARS-COV-2 can be aerosolized and transmitted through surgical smoke. Larger studies are urgently needed to corroborate these findings.

51. Tracking the introduction and spread of SARS-CoV-2 in coastal Kenya.

Githinji G¹², de Laurent ZR³, Mohammed KS³, Omuoyo DO³, Macharia PM⁴, Morobe JM³, Otieno E³, Kinyanjui SM^{3,5}, Agweyu A³, Maitha E⁶, Kitole B⁶, Suleiman T⁷, Mwakinangu M⁸, Nyambu J⁹, Otieno J¹⁰, Salim B¹¹, Kasera K¹², Kiiru J¹², Aman R¹², Barasa E^{5,13}, Warimwe G^{3,5}, Bejon P^{3,5}, Tsofa B³, Ochola-Oyier L¹³, Nokes DJ^{3,14}, Agoti CN^{3,15}.

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Nat Commun. 2021 Aug 10;121:4809. doi: 10.1038/s41467-021-25137-x.

ABSTRACT

Genomic surveillance of SARS-CoV-2 is important for understanding both the evolution and the patterns of local and global transmission. Here, we generated 311 SARS-CoV-2 genomes from samples collected in coastal Kenya between 17th March and 31st July 2020. We estimated multiple independent SARS-CoV-2 introductions into the region were primarily of European origin, although introductions could have come through neighboring countries. Lineage B.1 accounted for 74% of sequenced cases. Lineages A, B and B.4 were detected in screened individuals at the Kenya-Tanzania border or returning travelers. Though multiple lineages were introduced into coastal Kenya following the initial confirmed case, none showed extensive local expansion other than lineage B.1. International points of entry were important conduits of SARS-CoV-2 importations into coastal Kenya and early public health responses prevented established transmission of some lineages. Undetected introductions through points of entry including imports from elsewhere in the country gave rise to the local epidemic at the Kenyan coast.

52. Supply-chain strategies for essential medicines in rural western Kenya during COVID-19.

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Bull World Health Organ. 2021 May 1; 995:388-392. doi: 10.2471/BLT.20.271593. Epub 2021 Feb 10.

ABSTRACT

PROBLEM: The coronavirus disease 2019 COVID-19 pandemic has disrupted health systems worldwide and threatened the supply of essential medicines. Especially affected are vulnerable patients in low- and middle-income countries who can only afford access to public health systems. **APPROACH:** Soon after physical distancing and curfew orders began on 15 March 2020 in Kenya, we rapidly implemented three supply-chain strategies to ensure a continuous supply of essential medicines while minimizing patients' COVID-19 exposure risks. We redistributed central stocks of medicines to peripheral health facilities to ensure local availability for several months. We equipped smaller, remote health facilities with medicine tackle boxes. We also made deliveries of medicines to patients with difficulty reaching facilities.

LOCAL SETTING: To implement these strategies we leveraged our 30-year partnership with local health authorities in rural western Kenya and the existing revolving fund pharmacy scheme serving 85 peripheral health centres. **RELEVANT CHANGES:** In April 2020, stocks of essential chronic and non-chronic disease medicines redistributed to peripheral health facilities increased to 835 140 units, as compared with 316 330 units in April 2019. We provided medicine tackle boxes to an additional 46 health facilities. Our team successfully delivered medications to 264 out of 311 patients 84.9% with non-communicable diseases whom we were able to reach.

LESSONS LEARNT: Our revolving fund pharmacy model has ensured that patients' access to essential medicines has not been interrupted during the pandemic. Success was built on a community approach to extend pharmaceutical services, adapting our current supply-chain infrastructure and working quickly.

53. Mobility Patterns During COVID-19 Travel Restrictions in Nairobi Urban Informal Settlements: Who Is Leaving Home and Why?

Pinchoff J¹, Kraus-Perrotta C², Austrian K³, Tidwell JB⁴, Abuya T³, Mwanga D³, Kangwana B³, Ochako R³, Muluve E³, Mbushi F³, Nzioki M³, Ngo TD².

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J Urban Health. 2021 Apr; 982:211-221. doi: 10.1007/s11524-020-00507-w. Epub 2021 Feb 2

ABSTRACT

Nairobi's urban slums are ill equipped to prevent spread of the novel coronavirus disease COVID-19 due to high population density, multigenerational families in poorly ventilated informal housing, and poor sanitation. Physical distancing policies, curfews, and a citywide lockdown were implemented in March and April 2020 resulting in sharp decreases in movement across the city. However, most people cannot afford to stay home completely e.g., leaving daily to fetch water. If still employed, they may need to travel longer distances for work, potentially exposing them COVID-19 or contributing to its spread. We conducted a household survey across five urban slums to describe factors associated with mobility in the previous 24 h. A total of 1695 adults were interviewed, 63% female. Of these, most reported neighborhood mobility within their informal settlement 54%, 19% stayed home completely, and 27% reported long-distance mobility outside their informal settlement, mainly for work. In adjusted multinomial regression models, women were 58% more likely than men to stay home relative risk ratio RRR: 1.58, 95% confidence interval CI: 1.16, 2.14 and women were 60% less likely than men to report citywide mobility RRR: 0.40; 95% CI 0.31, 0.52. Individuals in the wealthiest quintile, particularly younger women, were most likely to not leave home at all. Those who reported citywide travel were less likely to have lost employment RRR: 0.49; 95% CI 0.38, 0.65 and were less likely to avoid public transportation RRR: 0.30; 95% CI 0.23, 0.39. Employment and job hunting were the main reasons for traveling outside of the slum; less than 20% report other reasons. Our findings suggest that slum residents who retain their employment are traveling larger distances across Nairobi, using public transportation, and are more likely to be male; this travel may put them at higher risk of COVID-19 infection but is necessary to maintain income. Steps to protect workers from COVID-19 both in the workplace and while in transit including masks, hand sanitizer stations, and reduced capacity on public transportation are critical as economic insecurity in the city increases due to COVID-19 mitigation measures. Workers must be able to commute and maintain employment to not be driven further into poverty. Additionally, to protect the majority of individuals who are only travelling locally within their settlement, mitigation measures such as making masks and handwashing stations accessible within informal settlements must also be implemented, with special attention to the burden placed on women.

54. **Examining the cost-effectiveness of personal protective equipment for formal healthcare workers in Kenya during the COVID-19 pandemic.**

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BMC Health Serv Res. 2021 Sep 20; 211:992. doi: 10.1186/s12913-021-07015-w.

ABSTRACT

BACKGROUND: Healthcare workers are at a higher risk of COVID-19 infection during care encounters compared to the general population. Personal Protective Equipment PPE have been shown to protect COVID-19 among healthcare workers, however, Kenya has faced PPE shortages that can adequately protect all healthcare workers. We, therefore, examined the health and economic consequences of investing in PPE for healthcare workers in Kenya.

METHODS: We conducted a cost-effectiveness and return on investment ROI analysis using a decision-analytic model following the Consolidated Health Economic Evaluation Reporting Standards CHEERS guidelines. We examined two outcomes: 1 the incremental cost per healthcare worker death averted, and 2 the incremental cost per healthcare worker COVID-19 case averted. We performed a multivariate sensitivity analysis using 10,000 Monte Carlo simulations.

RESULTS: Kenya would need to invest \$3.12 million 95% CI: 2.65-3.59 to adequately protect healthcare workers against COVID-19. This investment would avert 416 IQR: 330-517 and 30,041 IQR: 7243 - 102,480 healthcare worker deaths and COVID-19 cases respectively. Additionally, such an investment would result in a healthcare system ROI of \$170.64 million IQR: 138-209 – equivalent to an 11.04 times return.

CONCLUSION: Despite other nationwide COVID-19 prevention measures such as social distancing, over 70% of healthcare workers will still be infected if the availability of PPE remains scarce. As part of the COVID-19 response strategy, the government should consider adequate investment in PPE for all healthcare workers in the country as it provides a large return on investment and it is value for money.

55. **Mental health disorders among healthcare workers during the COVID-19 pandemic: a cross-sectional survey from three major hospitals in Kenya.**

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BMJ Open. 2021 Jun 9;116: e050316. doi: 10.1136/bmjopen-2021-050316.

ABSTRACT

BACKGROUND: COVID-19 is an international global health emergency and has posed a great challenge to mental well-being and resilience. Little is known about the mental health impact of COVID-19 among healthcare workers HCWs in sub-Saharan Africa or other low-resource settings.

METHODS: We conducted a cross-sectional study between August and November 2020 among HCWs recruited from three major hospitals in Kenya. The survey questionnaire consisted of six components: demographic and work title characteristics; information regarding care of patients with COVID-19; and symptoms of depression, anxiety, insomnia, distress and burnout, measured using standardised questionnaires. Multivariable logistic regression analysis was performed to identify factors associated with mental health disorders.

RESULTS: A total of 433 65.2% response rate individuals participated in the survey. Median age was 32.75 years, 58.4% were females and 68.8% were front-line workers. Depression, anxiety, insomnia, distress and burnout were reported in 53.6%, 44.3%, 41.1%, 31.0% and 45.8% of all participants, respectively. Front-line HCWs, females and doctors were at higher risk of mental health symptoms. Nearly half of participants reported inadequate resources or training to care for patients with COVID-19, and those in the government hospital were more likely to report mental health symptoms.

CONCLUSIONS: This is among the first studies examining mental health outcomes among HCWs during the COVID-19 pandemic in Kenya. Similar to other studies from around the world, HCWs directly involved with patients with COVID-19 reported higher rates of mental health symptoms. Mitigating strategies specific to Kenyan HCWs are urgently needed to help them cope with mental health symptoms during the pandemic.

56. **Mental Disorders Among Health Care Workers at the Early Phase of COVID-19 Pandemic in Kenya; Findings of an Online Descriptive Survey.**

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Front Psychiatry. 2021 Jul 22;12:665611. doi: 10.3389/fpsyt.2021.665611. eCollection 2021.

ABSTRACT

BACKGROUND: Healthcare workers responding to the Corona Virus Pandemic COVID-19 are at risk of mental illness. Data is scanty on the burden of mental disorders among Kenyan healthcare workers responding to the pandemic that can inform mental health and psychosocial support. The purpose of this study was to establish the frequency and associated factors of worry, generalized

anxiety disorder, depression, posttraumatic stress disorder and poor quality of sleep among Kenyan health care workers at the beginning of COVID-19 pandemic.

METHODS: We conducted an online survey among 1,259 health care workers in Kenya. A researcher developed social demographic questionnaire and several standardized tools were used for data collection. Standardized tools were programmed into Redcap, Research Electronic Data Capture and data analysis was performed using R Core Team. In all analysis a p-value < 0.05 was considered significant.

RESULTS: 66% of the participants reported experiencing worry related to COVID-19. 32.1% had depression, 36% had generalized anxiety, 24.2% had insomnia and 64.7% scored positively for probable Post Traumatic Stress Disorder PTSD. Depression was higher among females compared to men 36.5 vs. 26.9%, $p = 0.003$, workers <35 years old compared to older ones 38.1 vs. 26.4%, $p < 0.001$, and those who were not married compared to those who were married 40.6 vs. 27.6%, $p < 0.001$. Generalized anxiety was commoner among workers aged <35 years 43.5 vs. 29.3%, $p < 0.001$, females 41.7 vs. 29.2%, $p < 0.001$, those who were not married compared to the married 45.2 vs. 31.2%, $p < 0.001$ and those with <10 years working experience 41.6 to 20.5%, $p < 0.001$. Younger health care professional had a higher proportion of insomnia compared to the older ones 30.3 vs. 18.6%, $p < 0.001$. Insomnia was higher among those with <10 years' experience compared to those with more than 20 years' experience 27.3 vs. 17.6%, $p = 0.043$

CONCLUSION: Many Kenyan healthcare workers in the early phase of COVID-19 pandemic suffered from various common mental disorders with young, female professionals who are not married bearing the bigger burden. This data is useful in informing interventions to promote mental and psychosocial wellbeing among Kenyan healthcare workers responding to the pandemic.

57. Maintaining care delivery for non-communicable diseases in the face of the COVID-19 pandemic in western Kenya.

Kamano J^{1,2}, Naanyu V^{2,3}, Ayah R⁴, Limo O², Gathecha G⁵, Saenyi E², Jefwa P², Too K², Manji I⁶, Gala P⁷, Vedanthan R^{7,8}.

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Pan Afr Med J. 2021 Jun 22; 39:143. doi: 10.11604/pamj.2021.39.143.29708. eCollection 2021.

ABSTRACT

The coronavirus disease 2019 COVID-19 pandemic has disrupted health systems worldwide, gravely threatening continuity of care for non-communicable diseases NCDs, particularly in low-resource settings. We describe our efforts to maintain the continuity of care for patients with NCDs in rural western Kenya during the COVID-19 pandemic, using a five-component approach: 1 Protect: protect staff and patients; 2 Preserve: ensure medication availability and clinical services; 3 Promote: conduct health education and screenings for NCDs and COVID-19; 4 Process: collect process indicators and implement iterative quality improvement; and 5 Plan: plan for the future and ensure financial risk protection in the face of a potentially overwhelming health and economic catastrophe. As the pandemic continues to evolve, we must continue to pursue new avenues for improvement and expansion. We anticipate continuing to learn from the evolving local context and our global partners as we proceed with our efforts.

58. COVID-19 impacts on household energy & food security in a Kenyan informal settlement: The need for integrated approaches to the SDGs.

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Renew Sustain Energy Rev. 2021 Jul;144: None. doi: 10.1016/j.rser.2021.111018.

ABSTRACT

This longitudinal study presents the joint effects of a COVID-19 community lockdown on household energy and food security in an informal settlement in Nairobi, Kenya. Randomly administered surveys were completed from December 2019-March 2020 before community lockdown n = 474 and repeated in April 2020 during lockdown n = 194. Nearly universal 95% income decline occurred during the lockdown and led to 88% of households reporting food insecurity. During lockdown, a quarter of households n = 17 using liquefied petroleum gas LPG, a cleaner cooking fuel typically available in pre-set quantities e.g. 6 kg cylinders, switched to polluting cooking fuels kerosene, wood, which could be purchased in smaller amounts or gathered for free. Household size increases during lockdown also led to participants' altering their cooking fuel, and changing their cooking behaviors and foods consumed. Further, households more likely to switch away from LPG had lower consumption prior to lockdown and had suffered greater income loss, compared with households that continued to use LPG. Thus, inequities in clean cooking fuel access may have been exacerbated by COVID-19 lockdown. These findings demonstrate the complex relationship between household demographics, financial strain, diet and cooking patterns, and present the opportunity for a food-energy nexus approach to address multiple Sustainable Development Goals SDGs: achieving zero hunger SDG 2 and universal affordable, modern and clean energy access SDG 7 by 2030. Ensuring that LPG is affordable, accessible and meets the dietary and cooking needs of families should be a policy priority for helping improve food and energy security among the urban poor.

59. Randomised controlled trial of oxygen therapy and high-flow nasal therapy in African children with pneumonia.

Maitland K^{1,4}, Kiguli S², Olupot-Olupot P³, Hamaluba M⁴, Thomas K⁵, Alaroker F⁶, Opoka RO^{2,7}, Tagoola A⁷, Bandika V⁸, Mpoya A⁴, Mnjella H², Nabawanuka E², Okiror W³, Nakuya M⁶, Aromut D⁶, Engoru C⁶, Oguda E⁴, Williams TN^{1,4}, Fraser JF⁹, Harrison DA⁵, Rowan K⁵;

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Intensive Care Med. 2021 May;47(5):566-576. doi: 10.1007/s00134-021-06385-3. Epub 2021 May 5. PMID: 33954839; PMCID: PMC8098782.

ABSTRACT

PURPOSE: The life-saving role of oxygen therapy in African children with severe pneumonia is not yet established. **Methods:** The open-label fractional-factorial COAST trial randomised eligible Ugandan and Kenyan children aged > 28 days with severe pneumonia and severe hypoxaemia stratum (SpO₂ < 80%) to high-flow nasal therapy (HFNT) or low-flow oxygen (LFO: standard care) and hypoxaemia stratum (SpO₂ 80–91%) to HFNT or LFO (liberal strategies) or permissive hypoxaemia (ratio 1:1:2). Children with cyanotic heart disease, chronic lung disease or > 3 h receipt of oxygen were excluded. The primary endpoint was 48 h mortality; secondary endpoints included mortality or neurocognitive sequelae at 28 days.

RESULTS: The trial was stopped early after enrolling 1852/4200 children, including 388 in the severe hypoxaemia stratum (median 7 months; median SpO₂ 75%) randomised to HFNT (n = 194) or LFO (n = 194) and 1454 in the hypoxaemia stratum (median 9 months; median SpO₂ 88%) randomised to HFNT (n = 363) vs LFO (n = 364) vs permissive hypoxaemia (n = 727). Per-protocol 15% of patients in the permissive hypoxaemia group received oxygen (when SpO₂ < 80%). In the severe hypoxaemia stratum, 48-h mortality was 9.3% for HFNT vs. 13.4% for LFO groups. In the hypoxaemia stratum, 48-h mortality was 1.1% for HFNT vs. 2.5% LFO and 1.4% for permissive hypoxaemia. In the hypoxaemia stratum, adjusted odds ratio for 48-h mortality in liberal vs permissive comparison was 1.16 (0.49–2.74; p = 0.73); HFNT vs LFO comparison was 0.60 (0.33–1.06; p = 0.08). Strata-specific 28 day mortality rates were, respectively: 18.6, 23.4 and 3.3, 4.1, 3.9%. Neurocognitive sequelae were rare.

CONCLUSIONS: Respiratory support with HFNT showing potential benefit should prompt further trials.

60. Maternal and newborn care during the COVID-19 pandemic in Kenya: re-contextualising the community midwifery model.

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Hum Resour Health. 2020 Oct 7;18(1):75. doi: 10.1186/s12960-020-00518-3.

ABSTRACT

Peripartum deaths remain significantly high in low- and middle-income countries, including Kenya. The COVID-19 pandemic has disrupted essential services, which could lead to an increase in maternal and neonatal mortality and morbidity. Furthermore, the lockdowns, curfews, and increased risk for contracting COVID-19 may affect how women access health facilities. SARS-CoV-2 is a novel coronavirus that requires a community-centred response, not just hospital-based interventions. In this prolonged health crisis, pregnant women deserve a safe and humanised birth that prioritizes the physical and emotional safety of the mother and the baby. There is an urgent need for innovative strategies to prevent the deterioration of maternal and child outcomes in an already strained health system. We propose strengthening community-based midwifery to avoid unnecessary movements, decrease the burden on hospitals, and minimize the risk of COVID-19 infection among women and their newborns.

61. Prolonged SARS-CoV-2 RNA detection in anal/rectal swabs and stool specimens in COVID-19 patients after negative conversion in nasopharyngeal RT-PCR test.

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J Med Virol. 2020 Nov;92(11):2328-2331. doi: 10.1002/jmv.26007. Epub 2020 Aug 2.

ABSTRACT

Coronavirus disease 2019 (COVID-19) is a rapidly escalating pandemic that has spread to many parts of the world. Current data available on COVID-19 would suggest that SARS-CoV-2 virus is shed through the gastrointestinal system via feces. Some reports further indicate that a subset of COVID-19 patients may continue to have positive SARS-CoV-2 anal/rectal swab and stool test

after negative conversion of nasopharyngeal test. This paper analyses current literature to so as to shed some light on this issue. This article is protected by copyright. All rights reserved.

62. Impact of the societal response to COVID-19 on access to healthcare for non-COVID-19 health issues in slum communities of Bangladesh, Kenya, Nigeria and Pakistan: results of pre-COVID and COVID-19 lockdown stakeholder engagements.

Ahmed SAKS¹, Ajisola M², Azeem K³, Bakibinga P⁴, Chen YF⁵, Choudhury NN¹, Fayehun O⁶, Griffiths F⁷, Harris B⁵, Kibe P⁴, Lilford RJ⁹, Omigbodun A¹⁰, Rizvi N³, Sartori J⁹, Smith S⁵, Watson SI⁵, Wilson R⁵, Yeboah G¹¹, Aujla N⁵, Azam S¹³, Diggle PJ¹², Gill P⁵, Iqbal R³, Kabaria C⁴, Kisia L⁴, Kyobutungi C⁴, Madan JJ¹³, Mberu B⁴, Mohamed SF⁴⁵, Nazish A³, Odubanjo O¹⁴, Osuh ME¹⁵, Owoaje E¹⁶, Oyebode O⁵, Porto de Albuquerque J¹¹, Rahman O¹⁷, Tabani K³, Taiwo OJ¹⁸, Tregonning G¹¹, Uthman OA⁵, Yusuf R¹;

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Improving Health in Slums Collaborative.

BMJ Glob Health. 2020 Aug;5(8): e003042. doi: 10.1136/bmjgh-2020-003042.

ABSTRACT

INTRODUCTION: With COVID-19, there is urgency for policymakers to understand and respond to the health needs of slum communities. Lockdowns for pandemic control have health, social

and economic consequences. We consider access to healthcare before and during COVID-19 with those working and living in slum communities.

METHODS: In seven slums in Bangladesh, Kenya, Nigeria and Pakistan, we explored stakeholder perspectives and experiences of healthcare access for non-COVID-19 conditions in two periods: pre-COVID-19 and during COVID-19 lockdowns.

RESULTS: Between March 2018 and May 2020, we engaged with 860 community leaders, residents, health workers and local authority representatives. Perceived common illnesses in all sites included respiratory, gastric, waterborne and mosquito borne illnesses and hypertension. Pre-COVID, stakeholders described various preventive, diagnostic and treatment services, including well-used antenatal and immunization programmes and some screening for hypertension, tuberculosis, HIV and vector borne disease. In all sites, pharmacists and patent medicine vendors were key providers of treatment and advice for minor illnesses. Mental health services and those addressing gender-based violence were perceived to be limited or unavailable. With COVID-19, a reduction in access to healthcare services was reported in all sites, including preventive services. Cost of healthcare increased while household income reduced. Residents had difficulty reaching healthcare facilities. Fear of being diagnosed with COVID-19 discouraged healthcare seeking. Alleviators included provision of healthcare by phone, pharmacist's/drug vendors extending credit and residents receiving philanthropic or government support; these were inconsistent and inadequate.

CONCLUSION: Slum residents' ability to seek healthcare for non-COVID-19 conditions has been reduced during lockdowns. To encourage healthcare seeking, clear communication is needed about what is available and whether infection control is in place. Policymakers need to ensure that costs do not escalate and unfairly disadvantage slum communities. Remote consulting to reduce face-to-face contact and provision of mental health and gender-based violence services should be considered.

63. Assessing the prevalence of self-medication among healthcare workers before and during the 2019 SARS-CoV-2 (COVID-19) pandemic in Kenya.

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Saudi Pharm J. 2020 Oct;28(10):1149-1154. doi: 10.1016/j.jsps.2020.08.003. Epub 2020 Aug 14.

ABSTRACT

BACKGROUND: Self-medication plays a key role in public health as it influences both negatively and positively on the health of individuals and the existing healthcare systems. This is especially the case during public health emergencies like the 2019 SARS-CoV-2 disease.

OBJECTIVES: The study aimed at assessing the prevalence of self-medication before and during the outbreak of COVID-19 pandemic among healthcare workers and its associated factors. **METHODS:** Stratified sampling was used to select 379 study respondents. The authors developed an online questionnaire, pretested and submitted to various online professional groups of different cadres of healthcare workers. Collected data was analyzed using descriptive and inferential statistics. The data was presented in tables, graphs, percentages, and cross-tabulation with different variables. Multivariable logistic regression was used to ascertain factors that influence an individual's desire to self-medicate and associations were considered significant at $p < 0.05$.

RESULTS: The overall prevalence of self-medication increased from 36.2% ($n = 137$) before the pandemic to 60.4% ($n = 229$) during the pandemic. The respondents' gender, level of education, age, marital status, participation in physical activity, and drug reaction events, were significantly associated with self-medication before and during the outbreak ($P < 0.05$). Multivariable logistic regression analyses showed that participants engaging in physical activities, working during the day and being healthy were less likely to self-medicate ($p < 0.01$).

CONCLUSION: Self-medication is an important health issue, especially during the COVID-19 pandemic. Continuous awareness creation and sensitization could help in reducing self-medication practices among healthcare workers.

64. Prediction of the COVID-19 spread in African countries and implications for prevention and control: A case study in South Africa, Egypt, Algeria, Nigeria, Senegal and Kenya.

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Sci Total Environ. 2020 Aug 10; 729:138959. doi: 10.1016/j.scitotenv.2020.138959 Epub 2020 Apr 25.

ABSTRACT

COVID-19 (Corona Virus Disease 2019) is globally spreading and the international cooperation is urgently required in joint prevention and control of the epidemic. Using the Maximum-Hasting (MH) parameter estimation method and the modified Susceptible Exposed Infectious Recovered (SEIR) model, the spread of the epidemic under three intervention scenarios (suppression, mitigation, mildness) is simulated and predicted in South Africa, Egypt, and Algeria, where the epidemic situations are severe. The studies are also conducted in Nigeria, Senegal and Kenya,

where the epidemic situations are growing rapidly and the socio-economic are relatively under-developed, resulting in more difficulties in preventing the epidemic. Results indicated that the epidemic can be basically controlled in late April with strict control of scenario one, manifested by the circumstance in the South Africa and Senegal. Under moderate control of scenario two, the number of infected people will increase by 1.43-1.55 times of that in scenario one, the date of the epidemic being controlled will be delayed by about 10 days, and Algeria, Nigeria, and Kenya are in accordance with this situation. In the third scenario of weak control, the epidemic will be controlled by late May, the total number of infected cases will double that in scenario two, and Egypt is in line with this prediction. In the end, a series of epidemic controlling methods are proposed, including patient quarantine, close contact tracing, population movement control, government intervention, city and county epidemic risk level classification, and medical cooperation and the Chinese assistance.

65. Coronavirus Disease 2019 (COVID-19) in Kenya: Preparedness, response and transmissibility.

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J Microbiol Immunol Infect. 2020 Oct;53(5):671-673. doi: 10.1016/j.jmii.2020.04.011. Epub 2020 Apr 20.

ABSTRACT

The world and Kenya face a potential pandemic as the respiratory virus Coronavirus Disease 2019 (COVID-19) affects world populations. Nations have been forced to intervene and issue directions under executive orders to ensure the pandemic is contained. Kenya has reported 110 confirmed COVID-19 cases (as at 2nd April, 2020), three persons have succumbed and 2 people have fully recovered. Most of the affected people had entered/returned to Kenya from different parts of the world. Most of the people who have contracted COVID 19 are between the 16-74 years of age. As a result, since February 2020, Kenya put in place several precautionary measures to mitigate the pandemic in its early stages. However, the economic status of the population of country won't be simple to control COVID 19, if government won't integrate the realistic feasible timely plans. This article highlights the preparedness, response, transmissibility of Covid-19 and proposes intuitions to manage COVID-19 in Kenya. Currently it is clear that since first confirmation to current, the transmission of the COVID-19 is exponentially increasing in Kenya.

66. The effects of COVID-19 on the health and socio-economic security of sex workers in Nairobi, Kenya: Emerging intersections with HIV.

Kimani J^{1,2,3,4}, Adhiambo J³, Kasiba R³, Mwangi P⁵, Were V³, Mathenge J⁶, Macharia P⁶, Cholette F¹, Moore S⁷, Shaw S⁷, Becker M,^{1,7,8} Musyoki H⁸, Bhattacharjee P^{7,4}, Moses S^{1,7}, Fowke KR^{1,2,9,4}, McKinnon LR^{1,2,9,10}, Lorway R^{7,9}.

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Glob Public Health. 2020 Jul;15(7):1073-1082. doi: 10.1080/17441692.2020.1770831. Epub 2020 May 27

ABSTRACT

The COVID-19 pandemic, and its attendant responses, has led to massive health, social, and economic challenges on a global scale. While, so far, having a relatively low burden of COVID-19 infection, it is the response in lower- and middle- income countries that has had particularly dire consequences for impoverished populations such as sex workers, many of whom rely on regular income in the informal economic sector to survive. This commentary captures the challenges in Kenya posed by daily curfews and lost economic income, coupled with further changes to sex work that increase potential exposure to infection, stigmatization, violence, and various health concerns. It also highlights the ways in which communities and programmes have demonstrated resourcefulness in responding to this unprecedented disruption in order to emerge healthy when COVID-19, and the measures to contain it, subside.

67. Consequences of calamities and their management: The case of COVID-19 pandemic and flooding on inland capture fisheries in Kenya.

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J Great Lakes Res. 2020 Dec;46(6):1767-1775. doi: 10.1016/j.jglr.2020.09.007. Epub 2020 Sep 15.

ABSTRACT

During the period February to June 2020, heavy rainfall caused increases in levels and flooding in many lakes in East Africa. This coincided with the COVID-19 pandemic. These calamities

affected ecosystems and livelihoods, especially of fishers who depend on fisheries as their only source of livelihood. This study examined the effects of COVID-19 and flooding on the major inland capture fisheries in Kenya to illustrate the effect of such calamities on vulnerable communities to guide interventions. Socioeconomic data were collected across the fish value chains during the peak of COVID-19 pandemic and flooding in Kenya from May to early June 2020. The measures put in place to contain COVID-19 pandemic notably dusk to dawn curfew (66%) and lock-downs (28%) in major cities that act as main fish markets were cited as the main factors that influenced fishing and fishing trade. Negative consequences reported included livelihood losses from the COVID-19 pandemic. Reduced fishing time and trips as well as a decline in consumables such as boat fuel resulted in low fish catches. Although COVID-19 pandemic affected livelihoods, the fish stocks benefited from reduction in fishing effort. Similarly flooding led to livelihood and material losses but positively impacted on stocks through expansion of fish breeding and nursery areas. The respondents recommended that governments should have disaster preparedness programs in place to address such calamities. There is also need for more detailed research on calamities that are increasing in frequency to provide information and data to guide policy and interventions.

68. COVID-19 and community healthcare: perspectives from Nairobi's informal settlements.

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Pan Afr Med J. 2020 Jul 8;35(Suppl 2):106. doi: 10.11604/pamj.supp.2020.35.24532. eCollection 2020.

ABSTRACT

Urban slums are often characterized by overcrowding, inaccessibility of basic services such as running water and abject poverty. These may affect adherence to COVID-19 containment measures and worsen the effect of the virus on slum residents. We explore the overall practices and impact of the COVID-19 mitigation measures on the lives of Nairobi's urban poor. This was done through a three-week cycle of telephone interviews with residents, local healthcare providers, religious leaders and key decision makers in two of Nairobi's slums. As the number of COVID-19 cases increase in Kenya, greater efforts are needed to protect those in environments that make it challenging to implement the containment measures. Collaborative effort is needed to firmly and quickly implement social protections and food security measures, protection against domestic violence, and strengthening response at Level One (community level).

69. COVID-19 Curfews: Kenyan and Australian Litigation and Pandemic Protection

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J Law Med. 2020 Dec;28(1):117-131.

ABSTRACT

Historically and etymologically, curfews are public health measures imposed to guard against risks to health and safety. On occasion they have been deployed oppressively, disproportionately and without proper regard to their ramifications. It is important that they not be used during a pandemic unless there is sufficient medico-scientific reason to conclude that they will serve a constructive purpose and that they are the least restrictive available governmental response. Inevitably, they impact adversely on a variety of human rights, particularly freedom of movement. They isolate and inhibit human connection. However, in the context of a worldwide pandemic causing terrible loss of life, there are occasions where they may be a necessary adjunct to these restrictions. This article identifies a variety of scenarios in which curfews have been imposed on different populations and identifies legal challenges that have been made to them. In the context of the COVID-19 pandemic it reviews the Kenyan judgment of *Law Society of Kenya v Mutyambai* [2020] eKLR and the Victorian Supreme Court judgment of *Loiello v Giles* [2020] VSC 722. It contends that the carefully reasoned decisions in each instance constitute an important reassurance that decision-making about a lengthy curfew in order to reduce the spread of the COVID-19 virus was reasoned, rights-aware and suitably responsive to the risks posed.

70. Community interventions in Low-And Middle-Income Countries to inform COVID-19 control implementation decisions in Kenya: A rapid systematic review.

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PLoS One. 2020 Dec 8;15(12): e0242403. doi: 10.1371/journal.pone.0242403. eCollection 2020.

ABSTRACT

Globally, public health measures like face masks, hand hygiene and maintaining social distancing have been implemented to delay and reduce local transmission of COVID-19. To date there is emerging evidence to provide effectiveness and compliance to intervention measures on COVID-19 due to rapid spread of the disease. We synthesized evidence of community interventions and innovative practices to mitigate COVID-19 as well as previous respiratory outbreak infections which may share some aspects of transmission dynamics with COVID-19. In the study, we systematically searched the literature on community interventions to mitigate COVID-19, SARS

(severe acute respiratory syndrome), H1N1 Influenza and MERS (middle east respiratory syndrome) epidemics in PubMed, Google Scholar, World Health Organization (WHO), MEDRXIV and Google from their inception until May 30, 2020 for up-to-date published and grey resources. We screened records, extracted data, and assessed risk of bias in duplicates. We rated the certainty of evidence according to Cochrane methods and the GRADE approach. This study is registered with PROSPERO (CRD42020183064). Of 41,138 papers found, 17 studies met the inclusion criteria in various settings in Low- and Middle-Income Countries (LMICs). One of the papers from LMICs originated from Africa (Madagascar) with the rest from Asia 9 (China 5, Bangladesh 2, Thailand 2); South America 5 (Mexico 3, Peru 2) and Europe 2 (Serbia and Romania). Following five studies on the use of face masks, the risk of contracting SARS and Influenza was reduced OR 0.78 and 95% CI = 0.36-1.67. Equally, six studies on hand hygiene practices reported a reduced risk of contracting SARS and Influenza OR 0.95 and 95% CI = 0.83-1.08. Further two studies that looked at combined use of face masks and hand hygiene interventions showed the effectiveness in controlling the transmission of influenza OR 0.94 and 95% CI = 0.58-1.54. Nine studies on social distancing intervention demonstrated the importance of physical distance through closure of learning institutions on the transmission dynamics of disease. The evidence confirms the use of face masks, good hand hygiene and social distancing as community interventions are effective to control the spread of SARS and influenza in LMICs. However, the effectiveness of community interventions in LMICs should be informed by adherence of the mitigation measures and contextual factors taking into account the best practices. The study has shown gaps in adherence/compliance of the interventions, hence a need for robust intervention studies to better inform the evidence on compliance of the interventions. Nevertheless, this rapid review of currently best available evidence might inform interim guidance on similar respiratory infectious diseases like Covid-19 in Kenya and similar LMIC context.

71. **Mental health response to the COVID-19 pandemic in Kenya: a review.**

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Int J Ment Health Syst. 2020 Aug 18; 14:68. doi: 10.1186/s13033-020-00400-8. eCollection 2020.

ABSTRACT

BACKGROUND: The COVID-19 pandemic has exerted considerable impact on public mental health globally. With the pandemic rapidly rising in sub-Saharan Africa including Kenya, there is need to provide evidence to guide the mental health response in the region.

OBJECTIVES: The objective of this review is (1) to describe the mental health response to the COVID-19 pandemic in Kenya, guided by the Mental Health Preparedness and Action Framework (2) to offer context specific recommendations for improvement of the mental health response in Kenya. Such information could be useful in decision-making in Kenya as well as in the greater sub-Saharan Africa region.

METHODS: This narrative review is based on information obtained from official government documents released from 13th March 2020, the beginning of the pandemic in Kenya, up to 31st July 2020.

DISCUSSION: The COVID-19 response in Kenya has no formal mental health response plan. There is an unmet need for psychological first aid in the community. While guidelines for the management of mental health conditions during the COVID-19 pandemic have been prepared, implementation remains a major challenge due to a poorly resourced mental health system. There is no mental health surveillance system in place limiting ability to design evidence-based interventions.

CONCLUSION: We propose four key strategies for strengthening the mental health response in order to mitigate the harmful impact of COVID-19 on public mental health in Kenya: (1) preparation of a formal mental health response plan specific to the COVID-19 pandemic with allocation of funding for the response (2) training of community health workers and community health volunteers on psychological first aid to enable access to support for those in need during the pandemic (3) scaling up of mobile health to increase access to care (4) conducting systematic and continuous text message surveys on the mental health impact of the COVID-19 pandemic in order to inform decision-making.

72. The impact of the COVID-19 pandemic response on other health research.

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Bull World Health Organ. 2020 Sep 1;98(9):625-631. doi: 10.2471/BLT.20.257485. Epub 2020 Jul 6.

ABSTRACT

While governments have been focusing on the unprecedented disruption to the global economy caused by coronavirus disease 2019 (COVID-19) and the urgent need for COVID-19 research, other health research has become a casualty of the pandemic. Major research operations that are unrelated to COVID-19 have been significantly diminished or suspended entirely because of either COVID-19-related legal restrictions or logistical, staffing or operational concerns. Billions of people globally are currently affected by lockdowns or curfews. Since the timescale of such restrictive measures is unknown and subject to change, many studies are now in limbo and the welfare of tens of thousands of study participants is at risk. These circumstances have introduced complex ethical challenges that merit urgent attention from international sponsors, researchers and regulators. Certain sponsors and regulators have published guidelines on how the COVID-19-related disruptions to clinical research should be managed. Although these guidelines provide a good starting point in navigating the challenges of the evolving pandemic, they only apply to those researchers funded or governed by these bodies. Here, we provide guidelines on managing

such disruptions that apply beyond these specific settings. We highlight some of the effects of the COVID-19 pandemic on other ongoing research projects that are unrelated to COVID-19 and provide practical guidance on how the welfare of affected study participants should be managed. We conclude that policy-makers, sponsors, researchers and regulators must adopt a more flexible approach to ensure participant safety, while maintaining data integrity and complying with good clinical practices.

73. **A vulnerability index for COVID-19: spatial analysis at the subnational level in Kenya.**

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BMJ Glob Health. 2020 Aug;5(8): e003014. doi: 10.1136/bmjgh-2020-003014.

ABSTRACT

BACKGROUND: Response to the coronavirus disease 2019 (COVID-19) pandemic calls for precision public health reflecting our improved understanding of who is the most vulnerable and their geographical location. We created three vulnerability indices to identify areas and people who require greater support while elucidating health inequities to inform emergency response in Kenya.

METHODS: Geospatial indicators were assembled to create three vulnerability indices; Social Vulnerability Index (SVI), Epidemiological Vulnerability Index (EVI) and a composite of the two, that is, Social Epidemiological Vulnerability Index (SEVI) resolved at 295 sub counties in Kenya. SVI included 19 indicators that affect the spread of disease; socioeconomic deprivation, access to services and population dynamics, whereas EVI comprised 5 indicators describing comorbidities associated with COVID-19 severe disease progression. The indicators were scaled to a common measurement scale, spatially overlaid via arithmetic mean and equally weighted. The indices were classified into seven classes, 1-2 denoted low vulnerability and 6-7, high vulnerability. The population within vulnerabilities classes was quantified.

RESULTS: The spatial variation of each index was heterogeneous across Kenya. Forty-nine northwestern and partly eastern subcounties (6.9 million people) were highly vulnerable, whereas 58 subcounties (9.7 million people) in western and central Kenya were the least vulnerable for SVI. For EVI, 48 subcounties (7.2 million people) in central and the adjacent areas and 81 subcounties (13.2 million people) in northern Kenya were the most and least vulnerable, respectively. Overall (SEVI), 46 subcounties (7.0 million people) around central and southeastern were more vulnerable, whereas 81 subcounties (14.4 million people) were least vulnerable.

CONCLUSION: The vulnerability indices created are tools relevant to the county, national government and stakeholders for prioritisation and improved planning. The heterogeneous nature of the vulnerability indices underpins the need for targeted and prioritised actions based on the needs across the subcounties.

74. The impact of COVID-19 control measures on social contacts and transmission in Kenyan informal settlements.

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BMC Med. 2020 Oct 5;18(1):316. doi: 10.1186/s12916-020-01779-4 CMMID COVID-19 Working Group,

ABSTRACT

BACKGROUND: Many low- and middle-income countries have implemented control measures against coronavirus disease 2019 (COVID-19). However, it is not clear to what extent these measures explain the low numbers of recorded COVID-19 cases and deaths in Africa. One of the main aims of control measures is to reduce respiratory pathogen transmission through direct contact with others. In this study, we collect contact data from residents of informal settlements around Nairobi, Kenya, to assess if control measures have changed contact patterns, and estimate the impact of changes on the basic reproduction number (R₀).

METHODS: We conducted a social contact survey with 213 residents of five informal settlements around Nairobi in early May 2020, 4 weeks after the Kenyan government introduced enhanced physical distancing measures and a curfew between 7 pm and 5 am. Respondents were asked to report all direct physical and non-physical contacts made the previous day, alongside a questionnaire asking about the social and economic impact of COVID-19 and control measures. We examined contact patterns by demographic factors, including socioeconomic status. We described the impact of COVID-19 and control measures on income and food security. We compared contact patterns during control measures to patterns from non-pandemic periods to estimate the change in R₀.

RESULTS: We estimate that control measures reduced physical contacts by 62% and non-physical contacts by either 63% or 67%, depending on the pre-COVID-19 comparison matrix used. Masks were worn by at least one person in 92% of contacts. Respondents in the poorest socioeconomic quintile reported 1.5 times more contacts than those in the richest. Eighty-six

percent of respondents reported a total or partial loss of income due to COVID-19, and 74% reported eating less or skipping meals due to having too little money for food.

CONCLUSION: COVID-19 control measures have had a large impact on direct contacts and therefore transmission, but have also caused considerable economic and food insecurity. Reductions in R0 are consistent with the comparatively low epidemic growth in Kenya and other sub-Saharan African countries that implemented similar, early control measures. However, negative and inequitable impacts on economic and food security may mean control measures are not sustainable.

75. Infection prevention and control during the COVID-19 pandemic: challenges and opportunities for Kenyan public hospitals.

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Wellcome Open Res. 2020 Sep 10; 5:211. doi: 10.12688/wellcomeopenres.16222.1. eCollection 2020.

ABSTRACT

BACKGROUND: Infection prevention and control, and water sanitation and hygiene have an essential role in ensuring the quality of care and patient outcomes in hospitals. Using a modification of the World Health Organization's water sanitation and hygiene facility improvement tool, we undertook assessments in 14 public hospitals in Kenya in 2018. The hospitals received written feedback on areas where they could make improvements. Following the first confirmed cases of COVID-19 in Kenya, we were drawn to ask whether the results of our pre-pandemic survey had led to action, and whether or not the threat of COVID-19 had focused more attention on infection prevention and control and water sanitation and hygiene.

METHODS: Using a semi-structured interview guide, we carried out phone interviews with key hospital leaders in 11 of the 14 hospitals. The data were transcribed and coded into thematic areas. We draw on these interviews to describe the status and awareness of infection prevention and control.

RESULTS: The infection prevention and control committee members are training health workers on infection prevention and control procedures and proper use of personal protective equipment and in addition, providing technical support to hospital managers. While some hospitals have also accessed additional funds to improve infection prevention and control, they tended to be small amounts of money. Long-standing challenges with supplies of infection prevention and control

materials and low staff morale persist. Crucially, the reduced supply of personal protective equipment has led to fear and anxiety among health care personnel.

CONCLUSIONS: As funds are mobilized to support care for COVID-19, we ask that funds priorities infection prevention and control measures. This would have a profoundly positive effect on within hospital virus transmission, patient and staff safety but also lasting benefits beyond the COVID-19 pandemic.

76. Coronavirus Disease 2019 (COVID-19) set to increase burden of atherosclerotic cardiovascular disease in Kenya.

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Pan Afr Med J. 2020 Jul 21;35(Suppl 2):120. doi: 10.11604/pamj.supp.2020.35.24762. eCollection 2020.

ABSTRACT

The coronavirus disease 2019 (COVID-19), first reported in Kenya on March 13, 2020, is spreading rapidly. As of 30th June 2020, over 6,190 cases had been reported with a case fatality of 3.2%. Previous Coronavirus outbreaks have been associated with a significant burden of cardiovascular disease. For COVID-19, however, there has been no direct reference to potential long-term cardiovascular effects, especially in Africa where atherosclerotic diseases are an emerging challenge. This article, therefore, aims at describing possible long-term effects on the burden of atherosclerotic disease among Kenyans. Available data indicate that COVID-19 and cardiovascular disease share pathomechanisms and risk factors which include ACE2 receptor invasion and renin-angiotensin system signaling, oxidative stress, systemic inflammation, and endothelial dysfunction. Further, SARS-COV-2 infection causes dyslipidemia, dysglycemia, kidney, and liver disease. These mechanisms and diseases constitute risk factors for the initiation, progression, and complications of atherosclerosis. In Kenya, the common risk factors for atherosclerotic cardiovascular disease, and COVID-19 comprising Hypertension, Diabetes Mellitus, Obesity, Cigarette Smoking, Respiratory Tract Infections, Pulmonary Thromboembolism, Chronic Obstructive Pulmonary Disease, and Renal disease are not uncommon and continue to increase. In essence, the prevalence of the common risk factors/comorbidities, between COVID-19 and CVD occurrence of ACE2 receptors on the endothelium, and hence pathomechanisms of SARS-COV-2 infection imply that COVID-19 may increase the burden of atherosclerotic disease in Kenya. All due care should be taken, to prevent and effectively manage the disease, to avert an imminent epidemic of atherosclerotic disease.

77. Modeling the Effects of Nonpharmaceutical Interventions on COVID-19 Spread in Kenya.

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Interdiscip Perspect Infect Dis. 2020 Dec 18; 2020:6231461. doi:10.1155/2020/6231461. eCollection 2020.

ABSTRACT

Mathematical modeling of nonpharmaceutical interventions (NPIs) of coronavirus disease (COVID-19) in Kenya is presented. A susceptible-exposed-infected-recovered (SEIR) compartment model is considered with additional compartments of hospitalized population whose condition is severe or critical and the fatality compartment. The basic reproduction number (R_0) is computed by the next-generation matrix approach and later expressed as a time-dependent function so as to incorporate the NPIs into the model. The resulting system of ordinary differential equations (ODEs) is solved using fourth-order and fifth-order Runge-Kutta methods. Different intervention scenarios are considered, and the results show that implementation of closure of education institutions, curfew, and partial lockdown yields predicted delayed peaks of the overall infections, severe cases, and fatalities and subsequently containment of the pandemic in the country.

78. "We have a lot of home deliveries" A qualitative study on the impact of COVID-19 on access to and utilization of reproductive, maternal, newborn and child health care among refugee women in urban Eastleigh, Kenya.

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J Migr Health. 2020 Dec 9;1-2:100025. doi: 10.1016/j.jmh.2020.100025. eCollection 2020.

ABSTRACT

BACKGROUND: Little is known about how pregnant refugee women, and the frontline health care workers who serve them, are affected by the COVID-19 pandemic in terms of health, and health service access. Women refugees are classified as a vulnerable group with regard to pregnancy outcomes and access to maternal care, and may be disproportionately at risk for COVID-19 infection as they are likely to face unique barriers to information and access to reproductive health services during the pandemic. Few studies identify gaps that could inform potential interventions to improve service uptake for refugee women, particularly in the context of COVID-19. Yet, understanding how pregnant refugees are impacted in the context of the pandemic is critical to

developing and implementing strategies and measures that can help in their care and the delivery of health services.

AIMS: This study aimed to improve understanding of the impact of COVID-19 on women refugees' access to and utilisation of antenatal care, delivery and postnatal care in Eastleigh, Kenya. **METHODS:** The study was conducted in Eastleigh, a semi-urban centre in Nairobi. We conducted 25 in-depth interviews with facility and community health care staff (n = 10) and women attending antenatal (n = 10) and postnatal care services (n = 5) in October 2020. Data was analysed using NVIVO 12 software.

FINDINGS: Our findings suggest that within the first eight months of COVID-19, preferences for home deliveries by refugee women increased and health care workers reported having observed reduced utilisation of services and delayed care. Fear, economic challenges and lack of migrant-inclusive health system policies were key factors influencing home deliveries and delayed and low uptake of facility-based care.

CONCLUSIONS: The findings highlight the need to mitigate and lower barriers that prevent refugee women from seeking care at health facilities. One approach includes the development of refugee-inclusive public health policies, particularly during a pandemic, and the need to tailor health care services for refugees at facilities and in the communities.

79. Access to Healthcare in a time of COVID-19: Sex Workers in Crisis in Nairobi, Kenya.

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Glob Public Health. 2020 Oct;15(10):1430-1442. doi: 10.1080/17441692.2020.1810298. Epub 2020 Aug 20.

ABSTRACT

This paper uses empirical data collected from 117 female sex workers living in informal settlements in Nairobi and 15 healthcare providers to highlight specific effects of COVID-19 and related restrictions on healthcare access for the sex workers. We highlight the existing gender and health inequalities that have now been reinforced by the initial outbreak of the COVID-19 pandemic. Specifically, we focus on the most concerning healthcare needs for the sex workers including HIV prevention, care and treatment and sexual and reproductive healthcare. Our study findings reveal that the various restrictions imposed by the government to help curb the spread of COVID-19 to a large extent made it difficult for the sex workers to access their healthcare needs. The paper discusses the challenges of healthcare service delivery reflecting on some innovative and pioneering responses from health care providers to address the emergency situation.

80. Reorienting Nurturing Care for Early Childhood Development during the COVID-19 Pandemic in Kenya: A Review.

Shumba C^{1,2}, Maina R¹, Mbuthia G¹, Kimani R¹, Mbugua S³, Shah S⁴, Abubakar A⁵, Luchters S^{2,6,7,8}, Shaibu S¹, Ndirangu E¹.

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Int J Environ Res Public Health. 2020 Sep 25;17(19):7028. doi: 10.3390/ijerph17197028.

ABSTRACT

In Kenya, millions of children have limited access to nurturing care. With the Coronavirus disease 2019 (COVID-19) pandemic, it is anticipated that vulnerable children will bear the biggest brunt of the direct and indirect impacts of the pandemic. This review aimed to deepen understanding of the effects of COVID-19 on nurturing care from conception to four years of age, a period where the care of children is often delivered through caregivers or other informal platforms. The review has drawn upon the empirical evidence from previous pandemics and epidemics, and anecdotal and emerging evidence from the ongoing COVID-19 crisis. Multifactorial impacts fall into five key domains: direct health; health and nutrition systems; economic protection; social and child protection; and child development and early learning. The review proposes program and policy strategies to guide the reorientation of nurturing care, prevent the detrimental effects associated with deteriorating nurturing care environments, and support the optimal development of the youngest and most vulnerable children. These include the provision of cash transfers and essential supplies for vulnerable households and strengthening of community-based platforms for nurturing care. Further research on COVID-19 and the ability of children's ecology to provide nurturing care is needed, as is further testing of new ideas.

81. The socio-economic impacts of COVID-19 restrictions: Data from the coastal city of Mombasa, Kenya.

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Data Brief. 2020 Dec; 33:106317. doi: 10.1016/j.dib.2020.106317. Epub 2020 Sep 18.

ABSTRACT

The novel corona virus disease (Covid-19) outbreak has caused great uncertainty in all spheres of human life. The experience has been incredibly humbling given that no country or section of society, regardless of its wealth or status, has been spared. The pandemic is not only a health crisis, but is also having serious damaging effects on societies, economies and vulnerable groups. Timely response is necessary in order to alleviate human suffering and to prevent irreversible destruction of livelihoods. This paper provides preliminary data on the socio-economic impacts of Covid-19 in the coastal city of Mombasa, Kenya, at the time of government-imposed curfews and cessation of movement. We conducted online surveys for two weeks during the restrictions period. The data was collected using online questionnaires directed at the city residents. The data highlights the mobile gender gap resulting from gender inequalities, residents' reliance on the government for Covid-19 information but lack of trust for government interventions, inadequate provisions of essential services, and the residents' lack of preparedness to tackle similar challenges in the future.

82. HIV testing amid COVID-19: community efforts to reach men who have sex with men in three Kenyan counties.

Odinga MM¹, Kuria S², Muindi O³, Mwakazi P³, Njraini M⁴, Melon M⁴, Kombo B⁴, Kaosa S⁴, Kioko J⁴, Musimbi J⁴, Musyoki H⁵, Bhattacharjee P^{4,6}, Lorway R⁶.

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Gates Open Res. 2020 Oct 29; 4:117. doi: 10.12688/gatesopenres.13152.2. eCollection 2020.

ABSTRACT

In comparison to European and American countries, Kenya has been less impacted by the COVID-19 pandemic in terms of reported cases and mortalities. However, everyday life has been dramatically affected by highly restrictive government-imposed measures such as stay-at-home curfews, prohibitions on mobility across national and county boundaries, and strict policing, especially of the urban poor, which has culminated in violence. This open letter highlights the effects of these measures on how three community-based organizations CBOs deliver HIV programs and services to highly stigmatized communities of men who have sex with men living in the counties of Kisumu, Kiambu and Mombasa. In particular, emphasis is placed on how HIV testing programs, which are supported by systematic peer outreach, are being disrupted at a time when global policymakers call for expanded HIV testing and treatment targets among key

populations. While COVID 19 measures have greatly undermined local efforts to deliver health services to members and strengthen existing HIV testing programs, each of the three CBOs has taken innovative steps to adapt to the restrictions and to the COVID-19 pandemic itself. Although HIV testing in clinical spaces among those who were once regular and occasional program attendees dropped off noticeably in the early months of the COVID-19 lockdown, the program eventually began to rebound as outreach approaches shifted to virtual platforms and strategies. Importantly and unexpectedly, HIV self-testing kits proved to fill a major gap in clinic-based HIV testing at a time of crisis.

83. Genome Sequences of Human Coronavirus OC43 and NL63, Associated with Respiratory Infections in Kilifi, Kenya.

Kamau E¹, Luka MM^{2,3}, de Laurent ZR², Adema I², Agoti CN², Nokes DJ^{2,3}.

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Microbiol Resour Announc. 2019 Nov 14;846: e00730-19. doi: 10.1128/MRA.00730-19.

ABSTRACT

Coding-complete genomes of two human coronavirus OC43 strains and one NL63 strain were obtained by metagenomic sequencing of clinical samples collected in 2017 and 2018 in Kilifi, Kenya. Maximum likelihood phylogenies showed that the OC43 strains were genetically dissimilar and that the NL63 strain was closely related to NL63 genotype B viruses.

84. Risk factors for serological evidence of MERS-CoV in camels, Kenya, 2016-2017.

Sitawa R¹, Folorunso F², Obonyo M³, Apamaku M³, Kiambi S³, Gikonyo S³, Kiptiness J³, Njagi O⁴, Githinji J⁴, Ngoci J⁴, VonDobschuetz S⁵, Morzaria S⁵, Ihab E⁵, Gardner E⁵, Wiersma L⁵, Makonnen Y⁵.

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Prev Vet Med. 2020 Dec; 185:105197. doi: 10.1016/j.prevetmed.2020.105197. Epub 2020 Nov 2.

ABSTRACT

Middle East Respiratory Syndrome Coronavirus MERS-CoV is an emerging viral disease and dromedary camels are known to be the source of human spill over events. A cross-sectional epidemiological surveillance study was carried out in Kenya in 2017 to, 1 estimate MERS-CoV antibody seropositivity in the camel-dense counties of Turkana, Marsabit, Isiolo, Laikipia and Nakuru to identify, and 2 determine the risk factors associated with seropositivity in camels. Blood samples were collected from a total of 1421 camels selected using a multi-stage sampling method. Data were also collected from camel owners or herders using a pre-tested structured questionnaire. The sera from camel samples were tested for the presence of circulating antibodies to MERS-CoV using the anti-MERS-CoV IgG ELISA test. Univariate and multivariable statistical analysis were used to investigate factors potentially associated with MERS-CoV seropositivity in camels. The overall seropositivity in camel sera was 62.9 %, with the highest seropositivity recorded in Isiolo County 77.7 %, and the lowest seropositivity recorded in Nakuru County 14.0 %. When risk factors for seropositivity were assessed, the "Type of camel production system" {aOR = 5.4095 %CI: 1.67-17.49}, "Age between 1-2 years, 2-3 years and above 3 years" {aOR = 1.64 95 %CI: 1.04-2.59}, {aOR = 3.27 95 %CI: 3.66-5.61}" and {AOR = 6.12 95 %CI: 4.04-9.30} respectively and "Sex of camels" {aOR = 1.75 95 %CI: 1.27-2.41} were identified as significant predictors of MERS-CoV seropositivity. Our studies indicate a high level of seropositivity to MERS-CoV in camels in the counties surveyed, and highlights the important risk factors associated with MERS-CoV seropositivity in camels. Given that MERS-CoV is a zoonosis, and Kenya possesses the fourth largest camel population in Africa, these findings are important to inform the development of efficient and risk-based prevention and mitigation strategies against MERS-CoV transmission to humans.

84. Middle East Respiratory Syndrome Coronavirus MERS-CoV Seropositive Camel Handlers in Kenya.

Kiyong'a AN¹, Cook EAJ^{1,2}, Okba NMA³, Kivali V¹, Reusken C^{3,4}, Haagsmans BL³, Fèvre EM^{1,2}.

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Viruses. 2020 Apr 3; 124:396. doi: 10.3390/v12040396.

ABSTARCT

Middle East respiratory syndrome MERS is a respiratory disease caused by a zoonotic coronavirus MERS-CoV. Camel handlers, including slaughterhouse workers and herders, are at risk of acquiring MERS-CoV infections. However, there is limited evidence of infections among camel handlers in Africa. The purpose of this study was to determine the presence of antibodies to MERS-CoV in high-risk groups in Kenya. Sera collected from 93 camel handlers, 58 slaughterhouse workers and 35 camel herders, were screened for MERS-CoV antibodies using ELISA and PRNT. We found four seropositive slaughterhouse workers by PRNT. Risk factors

amongst the slaughterhouse workers included being the slaughter man the person who cuts the throat of the camel and drinking camel blood. Further research is required to understand the epidemiology of MERS-CoV in Africa in relation to occupational risk, with a need for additional studies on the transmission of MERS-CoV from dromedary camels to humans, seroprevalence and associated risk factors.

85. Transmission and evolutionary dynamics of human coronavirus OC43 strains in coastal Kenya investigated by partial spike sequence analysis, 2015-16.

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Virus Evol. 2020 Jun 2;61: veaa031. doi: 10.1093/ve/veaa031. eCollection 2020 Jan.

ABSTRACT

Human coronavirus OC43 HCoV-OC43 is a major contributor to seasonal outbreaks of acute respiratory illness ARI. The origins of locally circulating HCoV-OC43 strains and characteristics of their genetic diversity are unknown for most settings despite significance to effective HCoV control strategies. Between December 2015 and June 2016, we undertook ARI surveillance in coastal Kenya in nine outpatients and one inpatient health facility HF. Ninety-two patient samples tested HCoV-OC43 positive and forty 43.5% were successfully sequenced in spike S gene region 2,864 long, ~70%. Phylogenetic analysis confirmed co-circulation of two distinct HCoV-OC43 clades that closely clustered with genotype G n = 34, 85% and genotype H n = 6, 15% reference strains. Local viruses within the same clade displayed low genetic diversity yielding identical sequences in multiple HF. Furthermore, the newly sequenced Kenyan viruses showed close phylogenetic relationship to other contemporaneous sampled strains 2015-16 including those originating from distant places e.g., USA and China. Using a genetic similarity threshold of 99.1 per cent at nucleotide level, the HCoV-OC43 strains sampled globally between 1967 and 2019 fell into nine sequence clusters. Notably, some of these clusters appeared to have become extinct, or occurred only sporadically in a few geographical areas while others persisted globally for multiple years. In conclusion, we found that HCoV-OC43 strains spread rapidly both locally and across the globe with limited genetic evolution in the spike gene. Full-genome sequences that are spatio-temporally representative are required to advance understanding of the transmission pathways of this important human respiratory pathogen

86. High MERS-CoV seropositivity associated with camel herd profile, husbandry practices and household socio-demographic characteristics in Northern Kenya.

Ngere I¹, Munyua P², Harcourt J³, Hunsperger E², Thornburg N³, Muturi M⁴, Osoro E¹, Gachohi J^{1,5}, Bodha B⁶, Okotu B⁶, Oyugi J⁷, Jaoko W⁷, Mwatondo A⁸, Njenga K¹, Widdowson MA^{2,9}.

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Epidemiol Infect. 2020 Dec 1;148: e292. doi: 10.1017/S0950268820002939

ABSTRACT

Despite high exposure to Middle East respiratory syndrome coronavirus MERS-CoV, the predictors for seropositivity in the context of husbandry practices for camels in Eastern Africa are not well understood. We conducted a cross-sectional survey to describe the camel herd profile and determine the factors associated with MERS-CoV seropositivity in Northern Kenya. We enrolled 29 camel-owning households and administered questionnaires to collect herd and household data. Serum samples collected from 493 randomly selected camels were tested for anti-MERS-CoV antibodies using a microneutralisation assay, and regression analysis used to correlate herd and household characteristics with camel seropositivity. Households reared camels median = 23 camels and IQR 16-56, and at least one other livestock species in two distinct herds; a home herd kept near homesteads, and a range/fora herd that resided far from the homestead. The overall MERS-CoV IgG seropositivity was 76.3%, with no statistically significant difference between home and fora herds. Significant predictors for seropositivity $P \leq 0.05$ included camels 6-10 years old aOR 2.3, 95% CI 1.0-5.2, herds with ≥ 25 camels aOR 2.0, 95% CI 1.2-3.4 and camels from Gabra community aOR 2.3, 95% CI 1.2-4.2. These results suggest high levels of virus transmission among camels, with potential for human infection.

87. Surveillance of endemic human coronaviruses HCoV-NL63, OC43 and 229E associated with childhood pneumonia in Kilifi, Kenya.

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Wellcome Open Res. 2020 Sep 22; 5:150. doi: 10.12688/wellcomeopenres.16037.2. eCollection 2020.

ABSTRACT

INTRODUCTION: Human coronaviruses HCoV_s circulate endemically in human populations, often with seasonal variation. We describe the long-term patterns of paediatric disease associated with three of these viruses, HCoV-NL63, OC43 and 229E, in coastal Kenya.

METHODS: Continuous surveillance of pneumonia admissions was conducted at the Kilifi county hospital KCH located in the northern coastal region of Kenya. Children aged <5 years admitted to KCH with clinically defined syndromic severe or very severe pneumonia were recruited. Respiratory samples were taken and tested for 15 virus targets, using real-time polymerase chain reaction. Unadjusted odds ratios were used to estimate the association between demographic and clinical characteristics and HCoV positivity.

RESULTS: From 2007 to 2019, we observed 11,445 pneumonia admissions, of which 314 3.9% tested positive for at least one of the HCoV types surveyed in the study. There were 129 41.1% OC43, 99 31.5% 229E, 74 23.6% NL63 positive cases and 12 3.8% cases of HCoV to HCoV coinfection. Among HCoV positive cases, 47% n=147 were coinfecting with other respiratory virus pathogens. The majority of HCoV cases were among children aged <1 year 66%, n=208, though there was no change in the proportion infected by age. HCoV-OC43 was predominant of the three HCoV types throughout the surveillance period. Evidence for seasonality was not identified.

CONCLUSIONS: Overall, 4% of paediatric pneumonia admissions were associated with three endemic HCoV_s, with a high proportion of cases co-occurring with another respiratory virus, no clear seasonal pattern, and with the age-distribution of cases following that of pneumonia admissions i.e., highest in infants. These observations suggest, at most, a small severe disease contribution of endemic HCoV_s in this tropical setting and offer insight into their potential future burden and epidemiological characteristics.

88. Examining which clinicians provide admission hospital care in a high mortality setting and their adherence to guidelines: an observational study in 13 hospitals.

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ABSTRACT

BACKGROUND: We explored who actually provides most admission care in hospitals offering supervised experiential training to graduating clinicians in a high mortality setting where practices deviate from guideline recommendations.

METHODS: We used a large observational data set from 13 Kenyan county hospitals from November 2015 through November 2018 where patients were linked to admitting clinicians. We explored guideline adherence after creating a cumulative correctness of Paediatric Admission Quality of Care (cPAQC) score on a 5-point scale (0–4) in which points represent correct, sequential progress in providing care perfectly adherent to guidelines comprising admission assessment, diagnosis and treatment. At the point where guideline adherence declined the most we dichotomised the cPAQC score and used multilevel logistic regression models to explore whether clinician and patient-level factors influence adherence.

RESULTS There were 1489 clinicians who could be linked to 53 003 patients over a period of 3 years. Patients were rarely admitted by fully qualified clinicians and predominantly by preregistration medical officer interns (MOI, 46%) and diploma level clinical officer interns (COI, 41%) with a median of 28 MOI (range 11–68) and 52 COI (range 5–160) offering care per study hospital. The cPAQC scores suggest that perfect guideline adherence is found in $\leq 12\%$ of children with malaria, pneumonia or diarrhea with dehydration. MOIs were more adherent to guidelines than COI (adjusted OR 1.19 (95% CI 1.07 to 1.34)) but multimorbidity was significantly associated with lower guideline adherence.

CONCLUSION Over 85% of admissions to hospitals in high mortality settings that offer experiential training in Kenya are conducted by preregistration clinicians. Clinical assessment is good but classifying severity of illness in accordance with guideline recommendations is a challenge. Adherence by MOI with 6 years' training is better than COI with 3 years' training, performance does not seem to improve during their 3 months of paediatric rotations.

89. **Impact of 10-Valent Pneumococcal Conjugate Vaccine Introduction on Pneumococcal Carriage and Antibiotic Susceptibility Patterns Among Children Aged <5 Years and Adults With Human Immunodeficiency Virus Infection: Kenya, 2009-2013.**

Kobayashi M¹, Bigogo G², Kim L^{1,3}, Mogeni OD⁴, Conklin LM¹, Oduyo A², Odiembo H², Pimenta F¹, Ouma D⁴, Harris AM¹, Odero K⁴, Milucky JL¹, Ouma A⁴, Aol G¹, Audi A², Onyango C⁵, Cosmas L⁵, Jagero G^{2,6}, Farrar JL¹, da Gloria Carvalho M¹, Whitney CG¹, Breiman RF^{4,7}, Lessa FC¹.

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Clin Infect Dis. 2020 Feb 14;70(5):814-826. doi: 10.1093/cid/ciz285. PMID: 30959526; PMCID: PMC6942635.

ABSTRACT

BACKGROUND: Kenya introduced 10-valent pneumococcal conjugate vaccine (PCV10) among children <1 year in 2011 with catch-up vaccination among children 1–4 years in some areas. We assessed changes in pneumococcal carriage and antibiotic susceptibility patterns in children <5 years and adults.

METHODS: During 2009–2013, we performed annual cross-sectional pneumococcal carriage surveys in 2 sites: Kibera (children <5 years) and Lwak (children <5 years, adults). Only Lwak had catch-up vaccination. Nasopharyngeal and oropharyngeal (adults only) swabs underwent culture for pneumococci; isolates were serotyped. Antibiotic susceptibility testing was performed on isolates from 2009 and 2013; penicillin nonsusceptible pneumococci (PNSP) was defined as penicillin-intermediate or -resistant. Changes in pneumococcal carriage by age (<1 year, 1–4 years, adults), site, and human immunodeficiency virus (HIV) status (adults only) were calculated using modified Poisson regression, with 2009–2010 as baseline.

RESULTS: We enrolled 2962 children (2073 in Kibera, 889 in Lwak) and 2590 adults (2028 HIV+, 562 HIV–). In 2013, PCV10-type carriage was 10.3% (Lwak) to 14.6% (Kibera) in children <1 year and 13.8% (Lwak) to 18.7% (Kibera) in children 1–4 years. This represents reductions of 60% and 63% among children <1 year and 52% and 60% among children 1–4 years in Kibera and Lwak, respectively. In adults, PCV10-type carriage decreased from 12.9% to 2.8% (HIV+) and from 11.8% to 0.7% (HIV–). Approximately 80% of isolates were PNSP, both in 2009 and 2013.

CONCLUSIONS: PCV10-type carriage declined in children <5 years and adults post-PCV10 introduction. However, PCV10-type and PNSP carriage persisted in children regardless of catch-up vaccination.

90. Accuracy of diagnostic tests for respiratory syncytial virus infection within a paediatric hospital population in Kilifi County, Kenya.

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Wellcome Open Res. 2020 Jul 1; 5:155. doi: 10.12688/wellcomeopenres.16067.1. PMID: 32984548; PMCID: PMC7499398.

ABSTRACT

BACKGROUND: Respiratory syncytial virus (RSV)-induced lower respiratory tract disease is a prominent cause of hospitalization among children aged <5 years in developing countries. Accurate and rapid diagnostic tests are central to informing effective patient management and surveillance efforts geared towards quantifying RSV disease burden. This study sought to estimate the sensitivity (Se), specificity (Sp) (along with the associated factors) and predictive values of a direct immunofluorescence test (IFAT), and two real-time reverse transcription polymerase chain reaction (rRT-PCR) assays for RSV infection within a paediatric hospital population: a multiplex rRT-PCR (MPX) and Fast-Track Diagnostics® (FTD) Respiratory Pathogens 33 (Resp-33) rRT-PCR.

METHODS: The study enlisted 1458 paediatrics aged ≤59 months admitted with acute respiratory illness at the Kilifi County Hospital between August 2011 and December 2013. A Bayesian latent class modelling framework was employed to infer the tests' estimates based on the patients' diagnostic data from the three tests.

RESULTS: The tests posted statistically similar Se estimates: IFAT (93.7%, [90.7; 95.0]), FTD (97.8%, [94.6; 99.4]) and MPX (97.5%, [94.2; 99.3]). As for Sp, FTD registered a lower estimate (97.4%, [96.2; 98.2]) than MPX (99.7%, [99.0; 100.0]) but similar to IFAT (99.0%, [98.2; 99.6]). The negative and positive predictive values were strong (>91%) and closely mimicked the pattern given by the Se and Sp values respectively. None of the examined covariates (age, sex and pneumonia status) significantly influenced the accuracy of the tests.

CONCLUSIONS: The evaluation found little to choose between the three diagnostic tests. Nonetheless, with its relative affordability, the conventional IFAT continues to hold promise for use in patient care and surveillance activities for RSV infection within settings where children are hospitalised with severe acute respiratory illness.

91. **Global and Regional Burden of Hospital Admissions for Pneumonia in Older Adults: A Systematic Review and Meta-Analysis.**

Shi T¹, Denouel A², Tietjen AK³, Lee JW⁴, Falsey AR⁴, Demont C³, Nyawanda BO⁵, Cai B⁴, Fuentes R⁵, Stoszek SK⁶, Openshaw P⁷, Campbell H⁸, Nair H⁸.

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J Infect Dis. 2020 Oct 7;222(Suppl 7): S570-S576. doi: 10.1093/infdis/jiz053. PMID: 30849172.

ABSTRACT

Pneumonia constitutes a substantial disease burden among adults overall and those who are elderly. We aimed to identify all studies investigating the disease burden among older adults (age, ≥ 65 years) admitted to the hospital with pneumonia. We estimated the hospital admission rate and in-hospital case-fatality ratio (CFR) of pneumonia in older adults, stratified by age and economic status (industrialized vs developing), with data from a systematic review of studies published from 1996 through 2017 and from 8 unpublished population-based studies. We applied these rate estimates to population estimates for 2015 to calculate the global and regional burden in older adults who would have been admitted to the hospital with pneumonia that year. We estimated the number of in-hospital pneumonia deaths by combining in-hospital CFRs with hospital admission estimates from hospital-based studies. We identified 109 eligible studies; 73 used clinical pneumonia as the case definition, and 36 used radiologically confirmed pneumonia as the case definition. We estimated that, in 2015, 6.8 million episodes (uncertainty range [UR], 5.8–8.0 episodes) of clinical pneumonia resulted in hospital admissions of older adults worldwide. The hospital admission rate increased with advancing age and was higher in men. The total disease burden was likely underestimated when using the definition of radiologically confirmed pneumonia. Based on data from 52 hospital studies reporting data on pneumonia mortality, we estimated that about 1.1 million in-hospital deaths (UR, 0.9–1.4 in-hospital deaths) occurred among older adults. The burden of pneumonia requiring hospitalization among older adults is substantial. Appropriate prevention and management strategies should be developed to reduce its impact.

92. Resistance Gene in a High-Risk Sequence Type 15 *Klebsiella pneumoniae* Isolate from Kenya.

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Microbiol Resour Announc. 2020 Sep 24;9(39):e00783-20. doi: 10.1128/MRA.00783-20. PMID: 32972937; PMCID: PMC7516148.

ABSTRACT

Carbapenem-resistant gram-negative bacteria are an increasingly significant clinical threat globally. This risk may be underestimated in Kenya as only four carbapenemase genes in three bacterial species have been described. The study aimed to understand the antibiotic resistance profiles, genes, sequence types, and distribution of carbapenem-resistant gram-negative bacteria from patients in six hospitals across five Kenyan counties by bacterial culture, antibiotic susceptibility testing, and whole-genome sequence analysis. Forty-eight, non-duplicate, carbapenem non-susceptible, clinical isolates were identified across the five counties (predominantly in Nairobi and Kisii): twenty-seven *Acinetobacter baumannii*, fourteen *Pseudomonas aeruginosa*, three *Escherichia coli*, two *Enterobacter cloacae*, and two *Klebsiella pneumoniae*. All isolates were non-susceptible to β -lactam drugs with variable susceptibility to tigecycline (66%), minocycline (52.9%), tetracycline (29.4%), and levofloxacin (22.9%). Thirteen

P. aeruginosa isolates were resistant to all antibiotics tested. Eleven carbapenemase genes were identified: blaNDM-1, blaOXA-23, -58, -66, -69, and -91 in *A. baumannii* (STs 1, 2, 164 and a novel ST1475), blaNDM-1 in *E. cloacae* (STs 25,182), blaNDM-1, blaVIM-1 and -6, blaOXA-50 in *P. aeruginosa* (STs 316, 357, 654, and 1203), blaOXA-181, blaNDM-1 in *K. pneumoniae* (STs 147 and 219), and blaNDM-5 in *E. coli* (ST164). Five *A. baumannii* isolates had two carbapenemases, blaNDM-1, and either blaOXA-23 (4) or blaOXA-58 (1). AmpC genes were detected in *A. baumannii* (blaADC-25), *E. cloacae* (blaDHA-1 and blaACT-6, 16), and *K. pneumoniae* (blaCMY). Significant multiple-drug resistant genes were the pan-aminoglycoside resistance 16srRNA methyltransferase armA, rmtB, rmtC, and rmtF genes. This study is the first to report blaOXA-420, -58, -181, VIM-6, and blaNDM-5 in Kenyan isolates. High-risk STs of *A. baumannii* (ST1475, ST2), *E. cloacae* ST182, *K. pneumoniae* ST147, *P. aeruginosa* (ST357, 654), and *E. coli* ST167, ST648 were identified which present considerable therapeutic danger. The study recommends urgent carbapenem use regulation and containment of high-risk carbapenem-resistant bacteria.

93. Point-of-Care Lung Ultrasound Findings in Patients with COVID-19 Pneumonia.

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ABSTRACT

Patients with novel coronavirus disease (COVID-19) typically present with bilateral multilobar ground-glass opacification with a peripheral distribution. The utility of point-of-care ultrasound has been suggested, but detailed descriptions of lung ultrasound findings are not available. We evaluated lung ultrasound findings in 10 patients admitted to the internal medicine ward with COVID-19. All of the patients had characteristic glass rockets with or without the Birolleau variant (white lung). Thick irregular pleural lines and confluent B lines were also present in all of the patients. Five of the 10 patients had small subpleural consolidations. Point-of-care lung ultrasound has multiple advantages, including lack of radiation exposure and repeatability. Also, lung ultrasound has been shown to be more sensitive than a chest radiograph in detecting alveolar-interstitial syndrome. The utilization of lung ultrasound may also reduce exposure of healthcare workers to severe acute respiratory syndrome-coronavirus-2 and may mitigate the shortage of personal protective equipment. Further studies are needed to evaluate the utility of lung ultrasound in the diagnosis and management of COVID-19.

94. Digital auscultation in PERCH: Associations with chest radiography and pneumonia mortality in children.

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32852888; PMCID: PMC7692889.

ABSTRACT

BACKGROUND: Whether digitally recorded lung sounds are associated with radiographic pneumonia or clinical outcomes among children in low-income and middle-income countries is unknown. We sought to address these knowledge gaps.

METHODS: We enrolled 1 to 59monthold children hospitalized with pneumonia at eight African and Asian Pneumonia Etiology Research for Child Health sites in six countries, recorded digital stethoscope lung sounds, obtained chest radiographs, and collected clinical outcomes. Recordings were processed and classified into binary categories positive or negative for adventitial lung sounds. Listening and reading panels classified recordings and radiographs. Recording classification associations with chest radiographs with World Health Organization (WHO)-defined primary endpoint pneumonia (radiographic pneumonia) or mortality were evaluated. We also examined case fatality among risk strata.

RESULTS: Among children without WHO danger signs, wheezing (without crackles) had a lower adjusted odds ratio (aOR) for radiographic pneumonia (0.35, 95% confidence interval (CI): 0.15, 0.82), compared to children with normal recordings. Neither crackle only (no wheeze) (aOR: 2.13, 95% CI: 0.91, 4.96) or any wheeze (with or without crackle) (aOR: 0.63, 95% CI: 0.34, 1.15) were associated with radiographic pneumonia. Among children with WHO danger signs no lung recording classification was independently associated with radiographic pneumonia, although trends toward greater odds of radiographic pneumonia were observed among children classified with crackle only (no wheeze) or any wheeze (with or without crackle). Among children without WHO danger signs, those with recorded wheezing had a lower-case fatality than those without wheezing (3.8% vs. 9.1%, $p = .03$).

CONCLUSIONS: Among lower risk children without WHO danger signs digitally recorded wheezing is associated with a lower odd for radiographic pneumonia and with lower mortality. Although further research is needed, these data indicate that with further development digital auscultation may eventually contribute to child pneumonia care.

95. Glucose-6-phosphate dehydrogenase deficiency and susceptibility to childhood diseases in Kilifi, Kenya.

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ABSTRACT

Few previous studies have reported the effects of glucose-6-phosphate dehydrogenase (G6PD)–deficiency on child health in Africa. We conducted a case-control study in which cases (n = 6829) were children admitted, for any reason, to Kilifi County Hospital, Kenya, while controls (n = 10 179) were recruited from the surrounding community. Cases were subclassified based on their clinical and laboratory findings at admission. We calculated the prevalence of specific diseases by G6PD c.202 genotype, the only significant cause of G6PD-deficiency in this area, then estimated the association between genotype and admission with specific conditions using logistic regression. Among neonates, the prevalence of jaundice was higher in both G6PD c.202T heterozygotes (40/88; 45.5%; P = .004) and homo/hemizygotes (81/134; 60.5%; P < .0001) than in wild-type homozygotes (157/526; 29.9%). Median bilirubin levels also increased across the groups, being highest (239 mmol/L; interquartile range 96-390 mmol/L) in G6PD c.202T homo/hemizygotes. No differences were seen in admission hemoglobin concentrations or the prevalence of anemia or severe anemia by G6PD c.202 genotype. On case control analysis, G6PD heterozygosity was negatively associated with all-cause hospital admission (odds ratio 0.81; 95% confidence interval 0.73-0.90; P < .0001) and, specifically, admission with either pneumonia or Plasmodium falciparum parasitemia; while, conversely, it was positively associated with Gram-positive bacteremia. G6PD c.202T homo/heterozygosity was positively associated with neonatal jaundice, severe pneumonia, the receipt of a transfusion, and in-patient death. Our study supports the conclusion that G6PD c.202T is a balanced polymorphism in which a selective advantage afforded to heterozygous females against malaria is counterbalanced by increased risks of neonatal jaundice, invasive bacterial infections, and anemia.

96. The Aetiology of pneumonia from analysis of Lung aspirate and Pleural fluid samples: Findings from the PERCH study.

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ABSTRACT

BACKGROUND: An improved understanding of childhood pneumonia aetiology is required to inform prevention and treatment strategies. Lung aspiration is the gold standard specimen for pneumonia diagnostics. We report findings from analyses of lung and pleural aspirates collected in the Pneumonia Etiology Research for Child Health (PERCH) study.

METHODS: The PERCH study enrolled children aged 1–59 months hospitalized with World Health Organization defined severe or very severe pneumonia in 7 countries in Africa and Asia. Percutaneous trans-thoracic lung (LA) and pleural fluid (PF) aspiration was performed on a sample of pneumonia cases with radiological consolidation and/or pleural fluid in 4 countries. Venous blood and nasopharyngeal/oropharyngeal swabs were collected from all cases. Multiplex quantitative PCR and routine microbiologic culture were applied to clinical specimens.

RESULTS: Of 44 LAs performed within 3 days of admission on 622 eligible cases, 13 (30%) had a pathogen identified by either culture (5/44) or by PCR (11/29). A pathogen was identified in 12/14 (86%) PF specimens tested by either culture (9/14) or PCR (9/11). Bacterial pathogens were identified more frequently than viruses. All but one of the cases with a virus identified were co-infected with bacterial pathogens. *Streptococcus pneumoniae* (9/44 [20%]) and *Staphylococcus aureus* (7/14 [50%]) were the predominant pathogen identified in LA and PF, respectively.

CONCLUSIONS: Bacterial pathogens predominated in this selected subgroup of PERCH participants drawn from those with radiological consolidation or pleural fluid, with *S. pneumoniae* and *S. aureus* the leading pathogens identified.

97. Results from the Survey of Antibiotic Resistance (SOAR) 2015-18 in Tunisia, Kenya and Morocco: data based on CLSI, EUCAST (dose-specific) and pharmacokinetic/pharmacodynamic (PK/PD) breakpoints.

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ABSTRACT

OBJECTIVES: To determine antibiotic susceptibility of community-acquired respiratory tract infection (CA-RTI) isolates of *Streptococcus pneumoniae* and *Haemophilus influenzae* collected in 2015–18 from Tunisia, Kenya and Morocco.

METHODS: MICs were determined by CLSI broth microdilution and susceptibility was assessed using CLSI, EUCAST (dose-specific) and pharmacokinetic/ pharmacodynamic (PK/PD) breakpoints.

RESULTS: *S. pneumoniae* isolates from Tunisia (n = 79), Kenya (n = 44) and Morocco (n = 19) and *H. influenzae* isolates (n = 74) from Tunisia only were collected and analysed. Low antibiotic susceptibility was observed in *S. pneumoniae* from Tunisia, with >90% susceptible only to the fluoroquinolones (all breakpoints), penicillin (CLSI IV and EUCAST high-dose) and ceftriaxone (CLSI, EUCAST high-dose and PK/PD breakpoints). In addition, isolate susceptibility in Kenya was >90% to amoxicillin and amoxicillin/clavulanic acid (CLSI and PK/PD breakpoints). Antibiotic activity was highest in Morocco, where ≥89.5% of pneumococci were susceptible to most antibiotics, excluding trimethoprim/sulfamethoxazole (68.4% by CLSI or PK/PD and 79%–84.2% by EUCAST), macrolides (79%–84.2% by all breakpoints) and cefaclor (0% by EUCAST and 52.6% by PK/PD). The majority (≥86.5%) of *H. influenzae* isolates from Tunisia were susceptible to most antibiotics by all available breakpoints, except ampicillin and amoxicillin (almost one-third were β-lactamase positive), trimethoprim/sulfamethoxazole (51.4%–56.8%), cefaclor (1.4% by PK/PD), cefuroxime (4.1% by EUCAST), macrolides (1.4%–2.7% by PK/PD) and cefdinir (66.2% by PK/PD). The application of different EUCAST breakpoints for low and higher doses for some

of the antibiotics (amoxicillin, amoxicillin/clavulanic acid, ampicillin, penicillin, ceftriaxone, clarithromycin, erythromycin, levofloxacin and trimethoprim/sulfamethoxazole) allowed, for the first time in a SOAR study, the effect of raising the dosage on susceptibility to be quantified.

CONCLUSIONS: Low antibiotic susceptibility was observed in *S. pneumoniae* from Tunisia, but susceptibility was higher in isolates from Kenya and highest in those from Morocco. *H. influenzae* from Tunisia were highly susceptible to most antibiotics. These factors are important in decision making for empirical therapy of CA-RTIs.

98. Acceptability, adherence, and clinical outcomes, of amoxicillin dispersible tablets versus oral suspension in treatment of children aged 2-59 Months with pneumonia, Kenya: A cluster randomized controlled trial.

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PMCID:

PMC7160563.

ABSTRACT

Amoxicillin dispersible tablet (DT) is now recommended by the WHO as a first-line drug for the treatment of pneumonia in children below 5 years. The study aim was to compare acceptability, adherence and clinical outcome of amoxicillin DT and amoxicillin oral suspension (OS) in the treatment of children aged 2–59 months with pneumonia in Kenya. We conducted a two-arm cluster randomized controlled trial and utilized quantitative methods. The community unit was the unit of randomization. Children aged 2–59 months with pneumonia were enrolled and treated with either amoxicillin DT or OS. Acceptability was defined as the perception of taste of medication as the same or better compared to other medicines and expression of willingness of caregivers to use DT/OS in future, adherence was measured based on the dose, frequency, and duration of treatment, and clinical outcome as complete resolution of symptoms without change of antibiotic treatment. Equivalence was defined as a difference of $\leq 8\%$ between study arms. We found high levels of acceptability among both DT (93.9%) and OS (96.1%) arms (difference 2.3%, 90% CI -2.6-7.3). The objective measure of adherence on day four and the overall objective measure were significantly higher among children on DT compared to children on OS (88.7% vs. 41.5% (difference 47.2%, 90% CI 31.0–63.3) & 83.5% vs. 39% (difference 44.5%, 90% CI 27.9–60.9), respectively). Cure rates were high in both arms (DT (99.5%), OS (98.1%), difference 1.4%, 90%

CI -0.2-3.2). There is reported better adherence to Amoxicillin DT compared to OS and equivalence in acceptability and clinical outcomes.

99. Long-term impact of 10-valent pneumococcal conjugate vaccine in Kenya: nasopharyngeal *Streptococcus pneumoniae* carriage among children and adults six to seven years after vaccine introduction

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ABSTRACT

BACKGROUND: Kenya introduced the 10-valent pneumococcal conjugate vaccine (PCV10) in 2011, using three primary doses in infants aged <1 year and, in select areas, catch-up campaigns among older children. In the 1–2 years post-introduction, pneumococcal colonization remained stable while vaccine-type (VT) carriage declined. However, it is unknown to what extent vaccine serotypes still circulate in Kenya.

METHODS: We monitored pneumococcal carriage among participants in the Population-Based Infectious Disease Surveillance (PBIDS) platform in Asembo (rural western Kenya with a 2-dose catch-up for children aged 1–4 years) and Kibera (urban informal settlement in Nairobi with no catch up). PBIDS monitors the health of ~25,000 individuals in each site, and participants receive free care for infectious illnesses at a centrally located health facility in each site. From 1/2017 to 12/2018, nasopharyngeal swabs were collected from consenting PBIDS participants presenting to surveillance facilities with severe acute respiratory infection (SARI). SARI criteria included: for <5 years, cough or difficulty breathing plus indrawing, any IMCI danger signs, or hypoxemia [saturation <90%]; for ≥5 years, cough or difficulty breathing or chest pain plus temperature >38.0 C or hypoxemia. Swabs were frozen in skim milk-tryptone-glucose-glycerin media within 4 hours and underwent broth enrichment before isolation/identification. Isolates were serotyped by PCR and/or Quellung reaction.

RESULTS: Among 2475 SARI cases (1827 from Asembo and 648 from Kibera), 2048 (82.7%) had swabs collected and tested - 1597 (87.4%) and 451 (69.6%) from Asembo and Kibera, respectively. *Streptococcus pneumoniae* was isolated from 984 (48.1%); 704/1597 (44.1%) in Asembo and 280/451 (62.1%) in Kibera. Carriage was higher among children aged <5 years than persons aged ≥5 years: 64.8% vs. 34.4% in Asembo and 78.4% vs. 57.3% in Kibera. Among serotyped pneumococcal isolates, 71/681 (10.4%) and 114/950 (12.0%) were VT in Asembo and Kibera, respectively. In Asembo the VT-carriage prevalence was 6.6%, 6.5%, 7.5%, 3.1%, 3.4%, and 3.4% for age categories <12 months, 12–23 months, 24–59 months, 5–17 years, 18–49 years and ≥50 years, respectively. The corresponding VT prevalence by age for Kibera were 10.5%, 16.7%, 8.6%, 10.0%, 5.3% and 0.0%. The most common vaccine serotypes were 19F (n=34), 23F (n=15), 14 (n=12), 4 (n=4), and 1 (n=2) in Asembo and 14 (n=13), 23F (n=11), 5 (n=8), 19F (n=7), and 1 (n=5) in Kibera.

CONCLUSION: Pneumococcal vaccine serotypes persist in Kenya 6–7 years post-PCV10 introduction. VT carriage prevalence was lower across ages in the site with initial catch-up campaign (Asembo) relative to that with no catch-up (Kibera). A change in dosing schedule to include a booster dose may be necessary to further decrease carriage of PCV10 serotypes.

100. Seasonality and prevalence of respiratory syncytial virus, parainfluenza, and adenoviruses in Kenya: USAMRD-K supported Influenza-like illness surveillance program (2007-2018)

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ABSTRACT

BACKGROUND: Influenza-like illness (ILI) is a viral respiratory syndrome caused by a diverse range of etiologies. The prevalence of ILI varies by viral agent, population, geographical region, season and other factors. Above and beyond influenza viruses, human respiratory-syncytial-viruses (HRSV), human parainfluenzaviruses (HPIV), and human adenoviruses (HAdV) cause substantial ILI morbidity mostly in children (≤ 5 years), elderly (≥ 65 years) and immune-compromised people. Understanding the prevalence and seasonality of ILI etiologies is important because it enables us to recognize timings of the illness, factor that is crucial for planning for preventive and control (vaccination) or curative (treatments) measures. Utilizing data collected through the ILI surveillance program in Kenya between 2007 and 2018, we sought to identify the prevalence, and assess seasonality of HRSV, HPIV and HAdV.

METHODS: Syndromic surveillance data of participants presenting with ILI were collected from twelve sentinel hospitals, located in the different climatic zones of Kenya by the present Köppen-Geiger climate classification system. Participants were enrolled based on the case definition recommended by the World Health Organization. The nasopharyngeal swabs were analyzed for the specified viruses using polymerase chain reaction and virus isolation assays. We performed descriptive analyses by estimating overall proportions for each virus infection, and proportion per sentinel sites. Further, we visualized the distribution and observe the seasonal pattern by plotting the total number of cases for each virus per month from January 2007 to December 2018.

RESULTS: The overall prevalence of ILI caused by the three viruses were: HRSV 3.03%, HPIV 4.95%, and HAdV 3.17%. Amongst the HPIVs, HPIV-3 was the most dominant at 38.8%, followed by HPIV-1 (33.9%) and HPIV-2 (10.2%). The proportion of multiple parainfluenzavirus infections was 16.9%. This study did not delineate the types for HSRV, HAdV, and HPIV-4. Sentinel sites located in the coastal tropical savanna clime (Malindi and Port-Reitz), and western tropical forest

(Kisii and Kericho) mostly showed high proportions for the three viruses. We observed a seasonal pattern for HRSV where cases rose between April and July. There was no identifiable seasonality for HPIV and HAdV.

CONCLUSION: HRSV, HPIV and HAdV are prevalent among ILI patients in Kenya. The three viruses circulated concurrently at all the sentinel sites during the thirteen-year period. HPIV and HAdV were prevalent with no specific seasonal patterns. Further investigations are needed to determine the association of climatic and anthropologic factors with HRSV, HPIV and HAdV infections.

101. Using the synthetic control method to assess 10-valent pneumococcal conjugate vaccine impact on pneumonia among children aged <5 years in rural and urban Kenya

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ABSTRACT

BACKGROUND: Pneumonia is a leading cause of child death, and pneumococcal conjugate vaccines (PCV) are critical for reducing that burden. Data on PCV impact on pneumonia in sub-Saharan Africa are limited, and challenging to assess due to temporal changes in disease burden unrelated to vaccine. 10-valent PCV (PCV10) was introduced in Kenya in 2011. We used the synthetic control method to estimate impact on child pneumonia.

METHODS: We used data from the Population-Based Infectious Disease Surveillance (PBIDS), which monitors the health of people in defined catchment areas in Asembo (rural, western Kenya) and Kibera (urban informal settlement); each site has ~3,000 children aged <5 years. PBIDS participants receive free care for infectious illnesses at centrally located health facilities (hospital with small inpatient ward in Asembo and an outpatient clinic in Kibera); clinical data are collected by trained staff. We used the synthetic control method to assess PCV10 impact on pneumonia among children aged <12, 12–23, and 24–59 months. This method adjusts for non-vaccine-related trends in disease using a composite of control diseases. Pneumonia was defined as cough or difficulty breathing plus: tachypnea, indrawing, oxygen saturation <90%, convulsions, lethargy or unconscious. For control diseases we used discharge diagnoses, excluding those that could be affected by PCV10. We used data from 01/2008-12/2010 as baseline, 01/2011-12/2012 as transition and 01/2013-12/2018 as evaluation period. The rate ratio (RR) was calculated as sum of the observed pneumonia cases divided by the sum of the predicted (counterfactual) in the same period.

RESULTS: From 01/2008–12/2018, we recorded 55,803 visits for children <5 years in Asembo, including 50,637 (90.7%) outpatient and 5,166 (9.3%) inpatient. Pneumonia accounted for 7,490 (13.4%) visits overall, including 5,922 (79.1%) outpatient visits and 1,568 (20.9%) admissions. Among 71,174 visits in Kibera, 71,002 (98.8%) were managed at the clinic and 172 (0.2%) referred to a hospital. Overall, 7,752 (10.9%) visits for were pneumonia, including 7,610 (98.2%) outpatient and 142 (1.8%) referred for admission. In both sites we observed a significant reduction in pneumonia in all age groups. For Kibera, RR by age group were: age <12 months RR 0.37 (95% credible interval [CrI], 0.23-0.56); 12-23 months RR 0.29 (95%CrI, 0.14-0.51); 24-59 months RR 0.56 (95%CrI, 0.31-0.83). In Asembo, RR by age group were: age <12 months RR 0.35 (95%CrI, 0.20-0.64); 12-23 months RR 0.67 (95%CrI, 0.49-0.90); 24-59 months RR 0.51 (95%CrI, 0.35-0.73).

CONCLUSIONS: PCV10 is associated with substantial reduction of child pneumonia in rural and urban Kenya. Our data contribute to the growing evidence base of PCV impact in sub-Saharan Africa, and notably demonstrate protection against outpatient pneumonia. As Kenya graduates from GAVI support, these results help justify the need for continuous funding for PCV10 in the national immunization schedule.

102. Surveillance of Neuraminidase inhibition susceptibility of Influenza A virus (IAV) isolates obtained from Kenya, 2008 to 2017.

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ABSTRACT

BACKGROUND: Neuraminidase inhibitors have become the main antiviral agents useful in mitigation of IAV infections. Resistance to NAI both due to drug pressure and transmission of variants has been cited in certain geographical regions. Data on NAI susceptibility profile of influenza A isolates circulating within the Eastern African region remains scanty. Objectives: To characterize the NAI susceptibility of the 2008-2017 influenza A strains circulating in Kenya, by profiling known molecular markers in neuraminidase (NA) protein.

METHODS: The influenza A isolates were derived from samples obtained using parent protocol: WRAIR protocol # 1267 and KEMRI SSC #981). Reverse transcriptase PCR (RT-PCR) using Superscript III One-Step RT-PCR system with primers specific for NA and HA genes of human A/H1N1pdm09, H3N2 and H1N1 isolates. Selection of global NA and HA sequences from Gene bank for inclusion in the alignments was accomplished using BLAST. Multiple sequence alignments of M2 proteins were performed using MUSCLE V3.8. The phylogenetic reconstruction was carried out using the Bayesian method of tree inference.

RESULTS: During the study period 2008 to 2017 molecular analyses involving -75HA and 84NA IAV H1N1pdm09; 100HA and 79NA IAV H3N2; 26HA and 33NA seasonal IAV H1N1-genetic fragments was carried out to investigate their susceptibility to oseltamivir. Majority of the seasonal influenza A/H1N1 strains obtained in the 2008-2009 season possessed H275Y marker of Oseltamivir drug resistance. Few seasonal IAV H1N1 strains of 2008 lacked the H275Y substitution. The 2008 IAV H1N1 strains obtained in Kenya belonged to clades 2B.I while the 2009 strains were of the Northern European lineage (clades 2B.II) the dual signature H275Y and D354G substitutions. All the A/H1N1pdm09 strains obtained from Kenya from 2009-2017 were cluster 2 viruses possessing the main substitution S203T. Majority of the IAV H1N1pdm09 strains obtained from Kenya, 2009-2017 possessed Q136K substitution. The IAV H1N1pdm09 strains of 2015-2016 had S185T substitution same as vaccine strain A/Michigan/45/2015. IAV H1N1pdm09 strains obtained from Kenya, 2009-2017 lacked H275Y substitution. Additional substitutions, I223K and S247N were not detected. The IAV H3N2, HA phylogeny indicated that the 2012-2013 strains were Brisbane/10/2007-like possessing S144N substitution. Most of the 2016 IAV H3N2 Kenyan strains belonged to Perth/16/2009 clades defined by S/N144K substitution. The 2017 virus strains possessed 144S mutation same as the current vaccine strain Hongkong_4801_2014. All the Kenyan IAV H3N2 strains analyzed lacked R292K, Q136KD151V/D and N294S substitutions.

CONCLUSION: Most of the seasonal influenza A/H1N1 strains, 2008-2009 season obtained from Kenya possessed H275Y marker. The IAV H1N1pdm09 and IAV H3N2 strains obtained from Kenya have remained susceptible to Oseltamivir. Targeted NAI surveillance is important in timely detection and control of variant strains of great pandemic potential.

103. Understanding The Cellular Immunology To Pneumonia.

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ABSTRACT

BACKGROUND: Pneumonia both viral and bacterial is a leading cause of mortality in children under 5 years. Respiratory syncytial virus (RSV) is the commonest viral cause of pneumonia. The immune biomarkers for pneumonia mortality are not well understood. Molecular diagnosis including polymerase chain reaction as well as blood culture provide information on the microbial etiology of disease but provides little prognostic indication of survival outcome. Understanding the biomarkers of severe disease and mortality risk will aid in care decisions during admissions.

METHODS: To understand the mechanism of RSV pathology we analyzed airway immune cell phenotypes, we collected 98 nasal and oral-pharyngeal swabs samples from both RSV positive and negative children during the 2018/9 RSV epidemic season and phenotyped the resident airway immune cells through surface staining for B and T lymphocytes, neutrophils and monocytes using the flow cytometry technique. Difference in the immune cells phenotypes

between these groups was analyzed using the FlowJo software V10. We also used parallel high performance liquid chromatography tandem mass spectrometry to analyze airway proteome.

RESULTS: Using flow cytometry we observed a diverse population of innate and adaptive immune cells (including neutrophils, monocytes and lymphocytes) that was recruited to address the local infection. Neutrophil abundance in response to respiratory syncytial virus infection was inversely associated with commensal microbiota abundance as well as with a clinical marker of pneumonia severity and low oxygen saturation.

CONCLUSIONS: This increase in airway neutrophils was associated with increased expression of neutrophil granule proteins. This elevated expression profile was associated with changes in airway microbiota and reduced oxygen saturation.

104. Risk factors for death among children aged 5-14 years hospitalized with pneumonia: a retrospective cohort study in Kenya.

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ABSTRACT

INTRODUCTION: There were almost 1 million deaths in children aged between 5 and 14 years in 2017, and pneumonia accounted for 11%. However, there are no validated guidelines for pneumonia management in older children and data to support their development are limited. We sought to understand risk factors for mortality among children aged 5–14 years hospitalised with pneumonia in district-level health facilities in Kenya.

METHODS: We did a retrospective cohort study using data collected from an established clinical information network of 13 hospitals. We reviewed records for children aged 5–14 years admitted with pneumonia between 1 March 2014 and 28 February 2018. Individual clinical signs were examined for association with inpatient mortality using logistic regression. We used existing WHO criteria (intended for under 5s) to define levels of severity and examined their performance in identifying those at increased risk of death.

RESULTS: 1832 children were diagnosed with pneumonia and 145 (7.9%) died. Severe pallor was strongly associated with mortality (adjusted OR (aOR) 8.06, 95% CI 4.72 to 13.75) as were reduced consciousness, mild/moderate pallor, central cyanosis and older age (>9 years) (aOR >2). Comorbidities HIV and severe acute malnutrition were also associated with death (aOR 2.31, 95% CI 1.39 to 3.84 and aOR 1.89, 95% CI 1.12 to 3.21, respectively). The presence of clinical

characteristics used by WHO to define severe pneumonia was associated with death in univariate analysis (OR 2.69). However, this combination of clinical characteristics was poor in discriminating those at risk of death (sensitivity: 0.56, specificity: 0.68, and area under the curve: 0.62).

CONCLUSION: Children >5 years have high inpatient pneumonia mortality. These findings also suggest that the WHO criteria for classification of severity for children under 5 years do not appear to be a valid tool for risk assessment in this older age group, indicating the urgent need for evidence-based clinical guidelines for this neglected population.

105. Effect of 10-valent pneumococcal conjugate vaccine on the incidence of radiologically-confirmed pneumonia and clinically-defined pneumonia in Kenyan children: an interrupted time-series analysis.

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ABSTRACT

BACKGROUND: Pneumococcal conjugate vaccines (PCV) are highly protective against invasive pneumococcal disease caused by vaccine serotypes, but the burden of pneumococcal disease in low-income and middle-income countries is dominated by pneumonia, most of which is non-bacteraemic. We examined the effect of 10-valent PCV on the incidence of pneumonia in Kenya.

METHODS: We linked prospective hospital surveillance for clinically-defined WHO severe or very severe pneumonia at Kilifi County Hospital, Kenya, from 2002 to 2015, to population surveillance at Kilifi Health and Demographic Surveillance System, comprising 45 000 children younger than 5 years. Chest radiographs were read according to a WHO standard. A 10-valent pneumococcal

non-typeable Haemophilus influenzae protein D conjugate vaccine (PCV10) was introduced in Kenya in January, 2011. In Kilifi, there was a three-dose catch-up campaign for infants (aged <1 year) and a two-dose catch-up campaign for children aged 1–4 years, between January and March, 2011. We estimated the effect of PCV10 on the incidence of clinically-defined and radiologically-confirmed pneumonia through interrupted time-series analysis, accounting for seasonal and temporal trends.

FINDINGS: Between May 1, 2002 and March 31, 2015, 44 771 children aged 2–143 months were admitted to Kilifi County Hospital. We excluded 810 admissions between January and March, 2011, and 182 admissions during nurses' strikes. In 2002–03, the incidence of admission with clinically-defined pneumonia was 2170 per 100 000 in children aged 2–59 months. By the end of the catch-up campaign in 2011, 4997 (61.1%) of 8181 children aged 2–11 months had received at least two doses of PCV10 and 23 298 (62.3%) of 37 416 children aged 12–59 months had received at least one dose. Across the 13 years of surveillance, the incidence of clinically-defined pneumonia declined by 0.5% per month, independent of vaccine introduction. There was no secular trend in the incidence of radiologically-confirmed pneumonia over 8 years of study. After adjustment for secular trend and season, incidence rate ratios for admission with radiologically-confirmed pneumonia, clinically-defined pneumonia, and diarrhea (control condition), associated temporally with PCV10 introduction and the catch-up campaign, were 0.52 (95% CI 0.32–0.86), 0.73 (0.54–0.97), and 0.63 (0.31–1.26), respectively. Immediately before PCV10 was introduced, the annual incidence of clinically-defined pneumonia was 1220 per 100 000; this value was reduced by 329 per 100 000 at the point of PCV10 introduction.

INTERPRETATION: Over 13 years, admissions to Kilifi County Hospital for clinically-defined pneumonia decreased sharply (by 27%) in association with the introduction of PCV10, as did the incidence of radiologically-confirmed pneumonia (by 48%). The burden of hospital admissions for childhood pneumonia in Kilifi, Kenya, has been reduced substantially by the introduction of PCV10.

106. Birth size and early pneumonia predict linear growth among HIV-exposed uninfected infants.

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ABSTRACT

Stunting remains a global health priority, particularly in sub-Saharan Africa. Identifying determinants of linear growth in HIV-exposed uninfected (HEU) infants can inform interventions to prevent stunting in this vulnerable population. HIV-infected mothers and their uninfected infants were followed monthly from pregnancy to 12-month post-partum in Nairobi, Kenya. Mixed-effects models estimated the change in length-for-age z-score (LAZ) from birth to 12 months by environmental, maternal, and infant characteristics. Multivariable models included factors univariately associated with LAZ. Among 372 HEU infants, mean LAZ decreased from -0.54 (95% confidence interval [CI] [-0.67, -0.41]) to -1.09 (95% CI [-1.23, -0.96]) between 0 and 12 months. Declines in LAZ were associated with crowding (≥ 2 persons per room; adjusted difference [AD] in 0–12-month change: -0.46; 95% CI [-0.87, -0.05]), use of a pit latrine versus a flush toilet (AD: -0.29; 95% CI [-0.57, -0.02]), and early infant pneumonia (AD: -1.14; 95% CI [-1.99, -0.29]). Infants with low birthweight (<2,500 g; AD: 1.08; 95% CI [0.40, 1.76]) and birth stunting (AD: 1.11; 95% CI [0.45, 1.78]) experienced improved linear growth. By 12 months of age, 46 infants were stunted, of whom 11 (24%) were stunted at birth. Of the 34 infants stunted at birth with an available 12-month LAZ, 68% were not stunted at 12 months. Some low birthweight and birth-stunted HEU infants had significant linear growth recovery. Early infant pneumonia and household environment predicted poor linear growth and may identify a subgroup of HEU infants for whom to provide growth-promoting interventions.

107. Human metapneumovirus prevalence and patterns of subgroup persistence identified through surveillance of pediatric pneumonia hospital admissions in coastal Kenya, 2007–2016.

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ABSTRACT

BACKGROUND: Human metapneumovirus (HMPV) is an important respiratory pathogen that causes seasonal epidemics of acute respiratory illness and contributes significantly to childhood pneumonia. Current knowledge and understanding on its patterns of spread, prevalence and persistence in communities in low resource settings is limited.

METHODS: We present findings of a molecular-epidemiological analysis of nasal samples from children < 5 years of age admitted with syndromic pneumonia between 2007 and 2016 to Kilifi County Hospital, coastal Kenya. HMPV infection was detected using real-time RT-PCR and positives sequenced in the fusion (F) and attachment (G) genes followed by phylogenetic analysis. The association between disease severity and HMPV subgroup was assessed using Fisher's exact test.

RESULTS: Over 10 years, 274/6756 (4.1%) samples screened were HMPV positive. Annual prevalence fluctuated between years ranging 1.2 to 8.7% and lowest in the recent years (2014–

2016). HMPV detections were most frequent between October of one year to April of the following year. Genotyping was successful for 205/274 (74.8%) positives revealing clades A2b (41.0%) and A2c (10.7%), and subgroups B1 (23.4%) and B2 (24.9%). The dominance patterns were: clade A2b between 2007 and 11, subgroup B1 between 2012 and 14, and clade A2c in more recent epidemics. Subgroup B2 viruses were present in all the years. Temporal phylogenetic clustering within the subgroups for both local and global sequence data was seen. Subgroups occurring in each epidemic season were comprised of multiple variants. Pneumonia severity did not vary by subgroup ($p = 0.264$). In both the F and G gene, the sequenced regions were found to be predominantly under purifying selection.

CONCLUSION: Subgroup patterns from this rural African setting temporally map with global strain distribution, suggesting a well-mixed global virus transmission pool of HMPV. Persistence in the local community is characterized by repeated introductions of HMPV variants from the global pool. The factors underlying the declining prevalence of HMPV in this population should be investigated.

108. Patient-level cost of home- and facility-based child pneumonia treatment in Suba Sub County, Kenya.

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ABSTRACT

BACKGROUND: Globally, pneumonia accounted for 16% of deaths among children under 5 years of age and was one of the major causes of death overall in 2018. Kenya is ranked among the top 15 countries with regard to pneumonia prevalence and contributed approximately 74% of the world's annual pneumonia cases in 2018. Unfortunately, less than 50% of children with pneumonia receive appropriate antibiotics for treatment. Homa-Bay County implemented pneumonia community case management utilizing community health workers, as recommended by the World Health Organization (WHO), in 2014. However, since implementation of the program, the relative patient-level cost of home-based and facility-based treatment of pneumonia, as well as the main drivers of these costs in Suba Subcounty, remain uncertain. Therefore, the main objective of this study was to compare the patient-level costs of home-based treatment of pneumonia by a community health worker with those of health facility-based treatment.

METHODS AND FINDINGS: Using a cross-sectional study design, a structured questionnaire was used to collect quantitative data from 208 caregivers on the direct costs (consultation, medicine, transportation) and indirect costs (opportunity cost) of pneumonia treatment. The average household cost for the community managed patients was KSH 122.65 (\$1.29) compared with KSh 447.46 (\$4.71), a 4-fold difference, for those treated at the health facility. The largest cost drivers for home treatment and health facility treatment were opportunity costs (KSH 88.25 (\$ 0.93) and medicine costs (KSH 126.16 (\$ 1.33), respectively.

CONCLUSION: This study demonstrates that the costs incurred for home-based pneumonia management are considerably lower compared to those incurred for facility-based management. Opportunity costs (caregiver time and forgone wages) and the cost of medication were the key cost-drivers in the management of pneumonia at the health facility and at home, respectively. These findings emphasize the need to strengthen and scale community case management to overcome barriers and delays in accessing the correct treatment for pneumonia for sick children under 5 years of age.

109. Causes of severe pneumonia requiring hospital admission in children without HIV infection from Africa and Asia: the PERCH multi-country case-control study.

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Lancet. 2019. Aug 31;394(10200):757-779. doi: 10.1016/S0140-6736(19)30721-4. Epub 2019 Jun 27. Erratum in: Lancet. 2019 Aug 31;394(10200):736. PMID: 31257127; PMCID: PMC6727070.

ABSTRACT

BACKGROUND: Pneumonia is the leading cause of death among children younger than 5 years. In this study, we estimated causes of pneumonia in young African and Asian children, using novel analytical methods applied to clinical and microbiological findings.

METHODS: We did a multi-site, international case-control study in nine study sites in seven countries: Bangladesh, The Gambia, Kenya, Mali, South Africa, Thailand, and Zambia. All sites enrolled in the study for 24 months. Cases were children aged 1–59 months admitted to hospital with severe pneumonia. Controls were age-group-matched children randomly selected from communities surrounding study sites. Nasopharyngeal and oropharyngeal (NP-OP), urine, blood, induced sputum, lung aspirate, pleural fluid, and gastric aspirates were tested with cultures, multiplex PCR, or both. Primary analyses were restricted to cases without HIV infection and with abnormal chest x-rays and to controls without HIV infection. We applied a Bayesian, partial latent class analysis to estimate probabilities of aetiological agents at the individual and population level, incorporating case and control data.

FINDINGS: Between Aug 15, 2011, and Jan 30, 2014, we enrolled 4232 cases and 5119 community controls. The primary analysis group was comprised of 1769 (41·8% of 4232) cases without HIV infection and with positive chest x-rays and 5102 (99·7% of 5119) community controls without HIV infection. Wheezing was present in 555 (31·7%) of 1752 cases (range by site 10·6–97·3%). 30-day case-fatality ratio was 6·4% (114 of 1769 cases). Blood cultures were positive in 56 (3·2%) of 1749 cases, and *Streptococcus pneumoniae* was the most common bacteria isolated (19 [33·9%] of 56). Almost all cases (98·9%) and controls (98·0%) had at least one pathogen detected by PCR in the NP-OP specimen. The detection of respiratory syncytial virus (RSV), parainfluenza virus, human metapneumovirus, influenza virus, *S pneumoniae*, *Haemophilus influenzae* type b (Hib), *H influenzae* non-type b, and *Pneumocystis jirovecii* in NP-OP specimens was associated with case status. The aetiology analysis estimated that viruses accounted for 61·4% (95% credible interval [CrI] 57·3–65·6) of causes, whereas bacteria accounted for 27·3% (23·3–31·6) and *Mycobacterium tuberculosis* for 5·9% (3·9–8·3). Viruses were less common (54·5%, 95% CrI 47·4–61·5 vs 68·0%, 62·7–72·7) and bacteria more common (33·7%, 27·2–40·8 vs 22·8%, 18·3–27·6) in very severe pneumonia cases than in severe cases. RSV had the greatest aetiological fraction (31·1%, 95% CrI 28·4–34·2) of all pathogens. Human rhinovirus, human metapneumovirus A or B, human parainfluenza virus, *S pneumoniae*, *M tuberculosis*, and *H influenzae* each accounted for 5% or more of the aetiological distribution. We observed differences in aetiological fraction by age for *Bordetella pertussis*, parainfluenza types 1 and 3, parechovirus–enterovirus, *P jirovecii*, RSV, rhinovirus, *Staphylococcus aureus*, and *S pneumoniae*, and differences by severity for RSV, *S aureus*, *S pneumoniae*, and parainfluenza type 3. The leading ten pathogens of each site accounted for 79% or more of the site's aetiological fraction.

INTERPRETATION: In our study, a small set of pathogens accounted for most cases of pneumonia requiring hospital admission. Preventing and treating a subset of pathogens could substantially affect childhood pneumonia outcomes.

110. Childhood pneumonia in low-and-middle-income countries: An update.

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ABSTRACT

OBJECTIVES: To review epidemiology, aetiology and management of childhood pneumonia in low-and-middle-income countries.

DESIGN. Review of published English literature between 2013 and 2019. Results: Pneumonia remains a major cause of morbidity and mortality. Risk factors include young age, malnutrition, immunosuppression, tobacco smoke or air pollution exposure. Better methods for specimen collection and molecular diagnostics have improved microbiological diagnosis, indicating that pneumonia results from several organisms interacting. Induced sputum increases microbiologic yield for *Bordetella pertussis* or *Mycobacterium tuberculosis*, which has been associated with pneumonia in high TB prevalence areas. The proportion of cases due to *Streptococcus pneumoniae* and *Haemophilus influenzae b* has declined with new conjugate vaccines; *Staphylococcus aureus* and *influenzae non-type b* are the commonest bacterial pathogens; viruses are the most common pathogens. Effective interventions comprise antibiotics, oxygen and non-invasive ventilation. New vaccines have reduced severity and incidence of disease, but disparities exist in uptake.

CONCLUSION: Morbidity and mortality from childhood pneumonia has decreased but a considerable preventable burden remains. Widespread implementation of available, effective interventions and development of novel strategies are needed.

111. Determination of presence, levels and antimicrobial resistance pattern of MDR ESKAPEE pathogens in Kenyan hospital environments.

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ABSTRACT

INTRODUCTION: ESKAPEE (i.e., *Enterococcus*, *S. aureus*, *K. pneumoniae*, *A. baumannii*, *P. aeruginosa*, *Enterobacter spp*, *E. coli*) pathogens are the leading causes of hospital acquired infections (HAI) globally. Their increased levels of multidrug resistance (MDR) and persistence in hospital environments are of great concern as this increases the risk of acquisition of hard-to

treat-infections for patients and health workers. Given that treatment options for MDR ESKAPEE bacteria are increasingly limited, infection prevention and control (IPC) measures to stop transmission is the most sustainable solution. This warrants continuous surveillance of hospital environments to detect and eliminate MDR bacteria from the environment. No systematic surveys of hospitals across Kenya have been conducted to detect the presence of MDR ESKAPEE and identify the reservoirs which contribute to the risk of HAI to allow for targeted IPC intervention. This study therefore undertook a survey of 5 hospitals in 4 counties to determine if MDR ESKAPEE pathogens could be detected, at what frequencies and on what surfaces.

METHODS: The five hospitals in the study; Kericho (KCH), Kisumu (KDH) and Kisii (KSI) county hospitals, Malindi (MDH) and Kombewa (KOM) sub county hospitals were asked to identify the departments where hospital acquired infections were a challenge. Different areas within these departments were sampled by swabbing high touch areas and equipment with swabs in neutralising buffer. The swabs were shipped to the microbiology lab in KEMRI, vortexed, and 100ul of the suspension cultured on chromogenic agar plates (CHROMAgar) specific for each ESKAPEE pathogen. Isolates with phenotypes characteristic of the target organism were selected, identification confirmed and antibiotic susceptibility testing performed on the VITEK 2 automated ID/AST platform.

RESULTS: In total, 555 samples were collected. The frequency of MDR ESKAPEE pathogens detection in the study hospitals were as follows: KDH 18/113 (15.9%), KCH 18/123 (14.6%), KSI 15/110 (13.6%), KOM 4/88 (4.5%) and MDH 5/121 (4.1%). The MDR ESKAPEE pathogens identified and the frequency of detection in all the study hospitals were *K. pneumoniae* 19/555 (3.4%), *Enterobacter* species 18/555 (3.2%) *A. baumannii* 11/555 (2.0%), *S. aureus* 6/555 (1.1%), *E. faecium/faecalis* 2/555 (0.36%), *E. coli* 4/555 (0.7%) and *P. aeruginosa* 1/555 (0.002%). The predominant MDR ESKAPEE pathogen varied between hospitals with KDH, KCH and KSI being *K. pneumoniae* 8/124 (7%), *A. baumannii* 8/123 (6.4%) and *Enterobacter* species 7/110 (6.4%), respectively. Of note, 5/8 (63.0%) of *K. pneumoniae* isolated from KDH were extensively drug resistant (XDR). The areas with the highest frequency of MDR ESKAPEE also varied per hospital. The most contaminated departments in KDH and KSI was the newborn units 11/19 (57.9%) and 6/15 (40.0%), respectively) whereas in KCH, it was the maternity department 10/18 (55.6%). The items that were identified to be the most contaminated in the hospitals were baby cots/ couch 3/3 (100%), newborn incubators 3/3 (100%), room sinks and room inner door knobs.

CONCLUSION: ESKAPEE MDR organisms were detected across all five sampled hospitals in the specific departments that had self-reported challenges with HAI. Several surfaces/objects, including sinks which are the main IPC tool were found to act as potential reservoirs of HAI and transmission of dangerous pathogens. Improved disinfection methods tailored to the key pathogens in the environments and increased cleaning frequency of high risk areas/objects would potentially reduce the burden of HAI in these hospitals. Hospital should adopt periodic microbiological surveys of their hospitals environments to monitor for presence of dangerous pathogens and evaluate their IPC practices.

112. Frequency and antimicrobial susceptibility of ESKAPEE bacteria isolated from patients with urinary tract infection

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ABSTRACT

INTRODUCTION: Urinary tract infections (UTIs) are one of the most common causes of hospital out-patient visitations. In Kenya, urinary tract infections are treated empirically using common antibiotics and rarely are the pathogens identified and the susceptibility patterns determined in the laboratory. UTIs are becoming difficult to treat and often recur due to increasing drug resistance of bacterial pathogens. The predominant bacterial causes of UTIs and their antibiotic resistance patterns are not well described in Kenya. To better treat and manage this common infection a better understanding of the etiology and efficacy of drug treatment regimens is needed.

This study had three objectives: to identify the main causes of bacterial UTI infections, to determine the antibiotic profiles of several clinically significant pathogens: *E. coli*, *Enterobacter* spp, *S. aureus*, *K. pneumoniae*, *A. baumannii*, *P. aeruginosa* and *E. faecium/faecalis* (ESKAPEE) and to identify risk factors for acquisition of multidrug resistant bacteria.

METHODS: Patients with symptoms of bacterial urinary tract infections were recruited as subjects into an antimicrobial resistance surveillance study being conducted in hospitals in Kericho, Kisumu, Kilifi, Kisii and Nairobi counties. Demographic and clinical information was obtained for all recruited subjects. Urine samples were collected using clean-catch, bag or catheter methods and shipped to the microbiology labs at KEMRI for analysis. Bacteria were cultured on MacConkey, CLED and blood agar plates. Isolates were identified and antimicrobial susceptibility testing performed on the automated Vitek 2 platform.

RESULTS: 610 patients with UTIs were recruited of whom 68.2% females with the majority between the ages of 20 and 40 years and out-patients. 55% of the urine specimens collected had insignificant or no growth in culture. Of the 275 isolates obtained, *E. coli* was the most frequently isolated bacteria (107, ~40%) being found in approximately 20% of females and 13% of men. This was followed by *K. pneumoniae* (20, 7%) *S. haemolyticus* (17, 6%), *S. aureus* (11, 4%), *P. aeruginosa* (9), *Enterobacter* spp. (6) and *A. baumannii* (5). 62% (172/275) of the isolates were ESKAPEE pathogens. *Proteus* spp and *Citrobacter freundii* were typical UTI bacteria identified among the remaining bacteria identified. Among *E. coli*, 33.3% of *E. coli* isolates were ESBL producers. Levofloxacin resistance levels were 36.2% for *E. coli*, 30% for *K. pneumoniae* and 100% for *A. baumannii*. The highest rates of multidrug resistance (MDR) were detected in *P. aeruginosa* (78%), *Enterobacter* spp (50%) and *A. baumannii* (33%). More MDR isolates were from catheter compared to clean catch samples and from immunocompromised compared to non-immunocompromised subjects. *P. aeruginosa* was isolated only in male subjects and predominantly in catheter samples while *A. baumannii* was isolated only in catheter samples

CONCLUSION: Treatment of UTIs with antibiotics should be limited as the majority of UTIs are either non-bacterial or self-limiting in nature. The choice of antibiotics should be rational as ESKAPEE pathogens which have high MDR rates are key causes of UTIs. For high risk patients with UTIs culture and drug sensitivity tests should be conducted prior to treatment to reduce morbidity.

113. Detection of Oxa-23 and Oxa-181 carbapenamase genes and increased carbapenem resistance in clinical isolates of target gram- negative bacteria in Kenya.

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ABSTRACT

INTRODUCTION. Carbapenem drugs are used to treat extended spectrum beta lactamase (ESBL) gram negative bacteria (GNB). Emergence of carbapenemases increases the threat of extensively drug resistant GNB because of the coexistence on mobile elements with other resistance genes against other classes of antibiotic including last-line drugs like tigecycline and colistin. In Kenya, carbapenemase resistance has been reported in several studies and the carbapenemase genes NDM-1 identified in *Klebsiella pneumoniae* and *Acinetobacter baumannii* and VIM-2 in *Pseudomonas aeruginosa*. This study was conducted to assess the trends in carbapenem resistance in GNB, identify the resistance profiles of carbapenem resistant (CR) GNB and identify the genetic determinants of antibiotic resistance.

METHODS: Clinical isolates were obtained from subjects with symptoms of skin and soft tissue (SSTI) and urinary tract infections (UTI) bacterial infections enrolled in an active antimicrobial resistance surveillance study in eight hospitals in Kenya. The isolates were identified and antimicrobial susceptibility testing performed on the Vitek2 and /or Microscan platform on target GNB: *A. baumannii*, *P. aeruginosa*, *Enterobacter* spp., *K. pneumoniae* and *Escherichia coli*. CR isolates were identified per CLSI guidelines for each organism. CR resistance levels were tracked over a 4-year period 2015-2018. Whole genome sequencing and bioinformatics were used to identify the antibiotic resistance genes for a subset of multidrug resistant and CR isolates. Results: CR was identified in 9.3% (47) of the 506 target GN isolates identified over the study period. CR rates increased ~3-fold between 2015 and 2018 from 3.7% to 10.9%. The predominant CR organisms were *A. baumannii* (49%), followed by *P. aeruginosa* (30%), *E. coli* (11%), *Enterobacter* spp. (8.5%) and finally *K. pneumoniae* (2%). The 11 MDR CR isolates sequenced were predominantly from in-patient subjects, 5 had nosocomial infections, 6 had UTI and 5 had SSTI. These isolates were resistant to all penicillin, cephalosporin, quinolone and aminoglycoside drugs tested, chloramphenicol and sulfamethoxazole/trimethoprim and had variable resistance to tetracycline (80%), tigecycline (50%), minocycline (40%) and colistin (20%). The carbapenemase genes identified in *P. aeruginosa* were NDM-1(3), in *A. baumannii* Oxa-23 (5) and NDM-1 (1), in *K. pneumoniae* Oxa-181 (1), and in *Enterobacter cloacae* NDM-1(1). The MDR phenotype was attributable to the presence of a myriad of genes identified which confer resistance to all major drug classes.

DISCUSSION. The data indicates a considerable increase in carbapenem resistance in key pathogens associated with nosocomial infections particularly *A. baumannii* and *P. aeruginosa*. NDM-1 was the predominant carbapenemase present across species followed by the Class D carbapenemases Oxa-23 and -181 previously undescribed in Kenya. Oxa-181 is linked to an insertion sequence, ISEcp1 that spreads very efficiently. Oxa-23 producing MDR *A. baumannii* has

been associated with nosocomial outbreaks in the Middle East. The co-existence of multiple resistance genes necessitates a better understanding of the mechanisms of gene transmission to better predict the risk and rate of spread of extensively drug resistant GNB untreatable even with last-line drugs. Reserve drugs should be used sparingly to reduce morbidity associated with MDR CR infections and individuals with CR infections should be isolated to prevent nosocomial outbreaks.

114. Trends in antimicrobial resistance in clinical isolates of *Klebsiella pneumoniae*, *Escherichia coli* and *Enterobacter* species from Kenya (2015-2018)

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ABSTRACT

INTRODUCTION: Antibiotic resistance is on the rise in clinically significant bacteria of the family of Enterobacteriaceae including *Klebsiella pneumoniae*, *Enterobacter* spp. and *Escherichia coli* infections which cause significant morbidity and mortality in Kenya. Few long-term surveillance studies have been conducted among these key pathogens to ensure effective treatment of patients and appropriate management of key reserve drugs to treat multidrug resistant infections. This study analysed antibiotic resistant profiles of each species against a panel of antibiotics and the trends over a four year period in an ongoing systematic surveillance study in several hospitals in Kenya.

METHODS: The surveillance study conducted in 8 hospitals in 5 counties in Kenya analyzed specimens obtained from in- and out-patients with symptoms of bacterial urine, skin and soft tissue or throat infections. Urine, swabs or pus samples were cultured on sheep blood, CLED and MacConkey agar to isolate the target organisms. Bacterial identification and antimicrobial susceptibility tests against a panel of antibiotics were performed using the automated VITEK 2 and/or Microscan platforms. Minimal inhibitory concentrations of each drug were interpreted as per CLSI guidelines. Descriptive statistics generated on STATA were used to analyze the data. **Results:** 372 target bacterial isolates were obtained in the period 2015 - 2018: 45 *Enterobacter* species, 252 *E. coli* and 75 *K. pneumoniae*. *Enterobacter* species had the highest resistance levels for all antibiotics tested apart from levofloxacin exhibiting least resistance while *K. pneumoniae* had the highest proportion of ESBL producing isolates indicating greatest resistance to beta lactam antibiotics. Across species, the overall number of extended spectrum beta lactamase (ESBL) producing isolates rose from 29% in 2015 to 40% in 2018 indicating a 1.5-fold increase. Cefuroxime (2nd generation cephalosporin) and aztreonam (a monobactam) resistance rose from 28% and 21% in 2015 to 52% and 45% respectively in 2018 indicating a 2-fold increase. Resistance against cefepime, a 4th generation cephalosporin, increased from 29% in 2015 to 45% in 2018 indicating a 1.5-fold increase. Levofloxacin, a fluoroquinolone, registered minimum increase in resistance from 30% in 2015 to 32% in 2018. Antibiotic resistance against last resort drugs – meropenem, colistin and tigecycline- remained below 12% across the time period with no increase over time.

DISCUSSION: The rapid increase in ESBL production and up to 2-fold increase in antibiotic resistance for several drugs over 4 years highlight the rapidly growing challenge of multidrug resistant Enterobacteriaceae bacterial infections in hospitals in Kenya. Of concern are *Enterobacter* spp which, though the least common pathogens, are the most multidrug resistant. Fluoroquinolone drugs such as levofloxacin are still efficacious for treatment of the 3 bacterial species. Last-line antibiotics also show high efficacy in eliminating bacterial infections probably due to their low usage in Kenya however these can be inaccessible due to high cost or unavailability in public hospitals.

CONCLUSION: Continuous monitoring of antibiotic resistance trends such as reported here help inform treatment practices in hospitals across Kenya and provide data to guide national policies on antibiotic use and treatment guidelines for bacterial infections.

115. Antimicrobial Resistance is a major threat to achievement of Universal Health Coverage in Kenya

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ABSTRACT

Antimicrobial resistance (AMR) is now a global concern for public health - a political declaration endorsed by Heads of State at the United Nations General Assembly in New York in September 2016 signaled the world's commitment to taking a broad, coordinated approach to address the root causes of antimicrobial resistance using a One-Health approach. In Kenya, current rates of AMR are high for most infectious agents and constantly increasing. Examples are multi-drug resistant gastrointestinal pathogens such as typhoid, diarrhea-causing *E. coli*, cholera and invasive non-typhoidal salmonella, penicillin-resistant *Streptococcus pneumoniae*, vancomycin-resistant enterococci and multi-drug resistant *Mycobacterium tuberculosis*. *Klebsiella pneumoniae* is a major cause of hospital-acquired infections such as pneumonia, bloodstream infections, and infections in newborns and intensive-care unit patients. Because of resistance, carbapenem antibiotics do not work in more than half of people treated for *K. pneumoniae* infections. Emerging resistance to antimalarials and ARVs is also of major concern. If infections become resistant to 1st line drugs, more expensive alternatives (if available) must be used. It costs around a 100x more to treat MDR-TB than non-resistant TB. Longer durations of illness and treatment, often in hospitals, increase health care costs as well as the economic burden on families and societies. Such increased costs are a major challenge in resource-poor settings. Medical achievements are put at risk by AMR. Without effective antimicrobials for prevention and treatment of infections, organ transplantation, cancer chemotherapy and major surgery will be compromised. Growth of global trade and travel allows resistant microorganisms to spread rapidly around the world through humans and food. It is estimated that AMR may lead to GDP losses of >1% and that indirect costs affecting society may be >3 times direct health care costs. With their higher burden of infectious diseases AMR also affects developing economies more than developed ones

116. Appropriateness of clinical severity classification of new WHO childhood pneumonia guidance: a multi-hospital, retrospective, cohort study.

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ABSTRACT

BACKGROUND: Management of pneumonia in many low-income and middle-income countries is based on WHO guidelines that classify children according to clinical signs that define thresholds of risk. We aimed to establish whether some children categorized as eligible for outpatient treatment might have a risk of death warranting their treatment in hospital.

METHODS: We did a retrospective cohort study of children aged 2–59 months admitted to one of 14 hospitals in Kenya with pneumonia between March 1, 2014, and Feb 29, 2016, before revised WHO pneumonia guidelines were adopted in the country. We modelled associations with inpatient mortality using logistic regression and calculated absolute risks of mortality for presenting clinical features among children who would, as part of revised WHO pneumonia guidelines, be eligible for outpatient treatment (non-severe pneumonia).

FINDINGS: We assessed 16 162 children who were admitted to hospital in this period. 832 (5%) of 16 031 children died. Among groups defined according to new WHO guidelines, 321 (3%) of 11 788 patients with non-severe pneumonia died compared with 488 (14%) of 3434 patients with severe pneumonia. Three characteristics were strongly associated with death of children retrospectively classified as having non-severe pneumonia: severe pallor (adjusted risk ratio 5.9, 95% CI 5.1–6.8), mild to moderate pallor (3.4, 3.0–3.8), and weight-for-age Z score (WAZ) less than –3 SD (3.8, 3.4–4.3). Additional factors that were independently associated with death were: WAZ less than –2 to –3 SD, age younger than 12 months, lower chest wall in drawing, respiratory rate of 70 breaths per min or more, female sex, admission to hospital in a malaria endemic region, moderate dehydration, and an axillary temperature of 39°C or more.

INTERPRETATION: In settings of high mortality, WAZ less than –3 SD or any degree of pallor among children with non-severe pneumonia was associated with a clinically important risk of death. Our data suggest that admission to hospital should not be denied to children with these signs and we urge clinicians to consider these risk factors in addition to WHO criteria in their decision making.

117. Serotype Epidemiology among PCV-10 Vaccinated and Unvaccinated Children at Gertrude's Children's Hospital, Nairobi County: A Cross-Sectional Study.

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PMCID: PMC6367659.

ABSTRACT

BACKGROUND: *Streptococcus pneumoniae* (SPn) serotype replacement and emergence of multidrug resistant SPn has exacerbated the need for continuous regional serotype surveillance. We investigated SPn serotypes circulating among children ≤5 years in Nairobi County.

METHODS: *Streptococcus pneumoniae* stocks stored at -70°C in brain heart infusion medium were thawed at room temperature for 30 minutes. In total, 10 µl of the stored SPn cells were suspended in 50 µl PBS and gently vortexed. About 10 µl of the suspended cells were added on to a glass slide and mixed with 10 µl pooled antisera. The glass slide was swirled gently while observing for any reaction. The process was repeated with individual groups under various antisera pools. Those serotypes that did not belong to any pool were typed directly until a positive agglutination reaction was observed. The cells/PBS/serotype-specific antisera mixture on the glass slide were covered with a coverslip and observed under a phase contrast microscope at ×100 objective lens with oil emulsion. **Results:** Out of the 206 subjects sampled, 20.39% (n=42) were found to be carriers of SPn. About 52% (n=22) of the SPn carriers had received the recommended dose of PCV-10, while 48% (n=20) of the carriers had not. Almost all (n=41; 19.90% of subjects) isolates contained non-vaccine type SPn serotypes, while n=1 of the serotypes (in 0.49% of subjects) were untypeable. Serotypes 28F, 6A, 11A, 3 and 7C were prevalent in both vaccinated and unvaccinated children, whereas serotypes 23A, 17F, 35F, 48, 13 and 35B, and 23B, 20, 19B, 21, untypeable, 15B and 39 were found among unvaccinated and vaccinated groups, respectively.

CONCLUSIONS: All SPn serotypes isolated from the subjects sampled were non PCV-10 vaccine type. Therefore, Kenyan children receiving PCV-10 vaccine are not protected.

118. Impact of viral upper respiratory tract infection on the concentration of nasopharyngeal pneumococcal carriage among Kenyan children.

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ABSTRACT

Viral upper respiratory tract infection (URTI) predisposes to bacterial pneumonia possibly by facilitating growth of bacteria such as *Streptococcus pneumoniae* colonising the nasopharynx. We investigated whether viral URTI is temporally associated with an increase in nasopharyngeal pneumococcal concentration. Episodes of symptomatic RSV or rhinovirus URTI among children <5 years were identified from a longitudinal household study in rural Kenya. IyA and alu PCR were performed on nasopharyngeal samples collected twice-weekly, to measure the pneumococcal concentration adjusted for the concentration of human DNA present. Pneumococcal concentration increased with a fold-change of 3.80 (95%CI 1.95–7.40), with acquisition of RSV or rhinovirus, during 51 URTI episodes among 42 children. In repeated swabs from the baseline period, in the two weeks before URTI developed, within-episode variation was broad; within +/-112-fold range of the geometric mean. We observed only a small increase in nasopharyngeal pneumococcal concentration during RSV or rhinovirus URTI, relative to natural variation. Other factors, such as host response to viral infection, may be more important than nasopharyngeal pneumococcal concentration in determining risk of invasive disease.

119. An exploration of mortality risk factors in non-severe pneumonia in children using clinical data from Kenya.

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BMC Med. 2017 Dec 5;15(1):212. doi: 10.1186/s12916-017-0980-8. Erratum for: BMC Med. 2017 Nov 13;15(1):201. PMID: 29207988; PMCID: PMC5715507.

ABSTRACT

BACKGROUND: Childhood pneumonia is the leading infectious cause of mortality in children younger than 5 years old. Recent updates to World Health Organization pneumonia guidelines recommend outpatient care for a population of children previously classified as high risk. This revision has been challenged by policymakers in Africa, where mortality related to pneumonia is higher than in other regions and often complicated by comorbidities. This study aimed to identify factors that best discriminate inpatient mortality risk in non-severe pneumonia and explore whether these factors offer any added benefit over the current criteria used to identify children with pneumonia requiring inpatient care.

METHODS: We undertook a retrospective cohort study of children aged 2–59 months admitted with a clinical diagnosis of pneumonia at 14 public hospitals in Kenya between February 2014 and February 2016. Using machine learning techniques, we analysed whether clinical characteristics and common comorbidities increased the risk of inpatient mortality for non-severe pneumonia. The topmost risk factors were subjected to decision curve analysis to explore if using them as admission criteria had any net benefit above the current criteria.

RESULTS: Out of 16,162 children admitted with pneumonia during the study period, 10,687 were eligible for subsequent analysis. Inpatient mortality within this non-severe group was 252/10,687 (2.36%). Models demonstrated moderately good performance; the partial least squares discriminant analysis model had higher sensitivity for predicting mortality in comparison to logistic regression. Elevated respiratory rate (≥ 70 bpm), age 2–11 months and weight-for-age Z-score (WAZ) $< -3SD$ were highly discriminative of mortality. These factors ranked consistently across the different models. For a risk threshold probability of 7–14%, there is a net benefit to admitting the patient sub-populations with these features as additional criteria alongside those currently used to classify severe pneumonia. Of the population studied, 70.54% met at least one of these criteria. Sensitivity analyses indicated that the overall results were not significantly affected by variations in pneumonia severity classification criteria.

CONCLUSIONS: Children with non-severe pneumonia aged 2–11 months or with respiratory rate ≥ 70 bpm or very low WAZ experience risks of inpatient mortality comparable to severe pneumonia. Inpatient care is warranted in these high-risk groups of children.

120. Utility of Polymerase Chain Reaction in Induced Sputum Specimens for Determining the Causes of Childhood Pneumonia in Resource-Poor Settings: Findings From the Pneumonia Etiology

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Clin Infect Dis. 2017 Jun 15;64(suppl_3):S289-S300. doi: 10.1093/cid/cix098. PMID: 28575363; PMCID: PMC5447848.

ABSTRACT

BACKGROUND: Sputum examination can be useful in diagnosing the cause of pneumonia in adults but is less well established in children. We sought to assess the diagnostic utility of polymerase chain reaction (PCR) for detection of respiratory viruses and bacteria in induced sputum (IS) specimens from children hospitalized with severe or very severe pneumonia.

METHODS: Among children aged 1–59 months, we compared organism detection by multiplex PCR in IS and nasopharyngeal/oropharyngeal (NP/OP) specimens. To assess whether organism presence or density in IS specimens was associated with chest radiographic evidence of pneumonia (radiographic pneumonia), we compared prevalence and density in IS specimens from children with radiographic pneumonia and children with suspected pneumonia but without chest radiographic changes or clinical or laboratory findings suggestive of pneumonia (nonpneumonia group).

RESULTS: Among 4232 cases with World Health Organization–defined severe or very severe pneumonia, we identified 1935 (45.7%) with radiographic pneumonia and 573 (13.5%) with nonpneumonia. The organism detection yield was marginally improved with IS specimens (96.2% vs 92.4% for NP/OP specimens for all viruses combined [$P = .41$]; 96.9% vs 93.3% for all bacteria combined [$P = .01$]). After accounting for presence in NP/OP specimens, no organism was detected more frequently in the IS specimens from the radiographic pneumonia compared with the nonpneumonia cases. Among high-quality IS specimens, there were no statistically significant differences in organism density, except with cytomegalovirus, for which there was a higher quantity in the IS specimens from cases with radiographic pneumonia compared with the nonpneumonia cases (median cycle threshold value, 27.9 vs 28.5, respectively; $P = .01$).

CONCLUSIONS: Using advanced molecular methods with IS specimens provided little additional diagnostic information beyond that obtained with NP/OP swab specimens.

121. Azithromycin to prevent post-discharge morbidity and mortality in Kenyan children: a protocol for a randomised, double-blind, placebo-controlled trial (the Toto Bora trial).

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BMJ Open. 2017 Dec 29;7(12): e019170. doi: 10.1136/bmjopen-2017-019170. PMID: 29289941; PMCID: PMC5778294.

ABSTRACT

INTRODUCTION: Child mortality due to infectious diseases remains unacceptably high in much of sub-Saharan Africa. Children who are hospitalized represent an accessible population at particularly high risk of death, both during and following hospitalisation. Hospital discharge may be a critical time point at which targeted use of antibiotics could reduce morbidity and mortality in high-risk children. **Methods and analysis** In this randomised, double-blind, placebo-controlled trial (Toto Bora Trial), 1400 children aged 1–59 months discharged from hospitals in Western Kenya, in Kisii and Homa Bay, will be randomised to either a 5-day course of azithromycin or placebo to determine whether a short course of azithromycin reduces rates of re-hospitalisation and/or death in the subsequent 6-month period. The primary analysis will be modified intention-to-treat and will compare the rates of re-hospitalisation or death in children treated with azithromycin or placebo using Cox proportional hazard regression. The trial will also evaluate the effect of a short course of azithromycin on enteric and nasopharyngeal infections and cause-specific morbidities. We will also identify risk factors for post discharge morbidity and mortality and subpopulations most likely to benefit from post discharge antibiotic use. Antibiotic resistance in *Escherichia coli* and *Streptococcus pneumoniae* among enrolled children and their primary caregivers will also be assessed, and cost-effectiveness analyses will be performed to inform policy decisions. Ethics and dissemination Study procedures were reviewed and approved by the institutional review boards of the Kenya Medical Research Institute, the University of Washington and the Kenyan Pharmacy and Poisons Board. The study is being externally monitored, and a data safety and monitoring committee has been assembled to monitor patient safety and to evaluate the efficacy of the intervention. The results of this trial will be published in peer-reviewed scientific journals and presented at relevant academic conferences and to key stakeholders.

122. Effect of enhanced feedback to hospitals that are part of an emerging clinical information network on uptake of revised childhood pneumonia treatment policy:

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Study protocol for a cluster randomized trial. *Trials*. 2017 Sep 7;18(1):416. doi: 10.1186/s13063-017-2152-8. PMID: 28877729; PMCID: PMC5588612.

ABSTRACT

The national pneumonia treatment guidelines in Kenya changed in February 2016 but such guideline changes are often characterized by prolonged delays in affecting practice. We designed an enhanced feedback intervention, delivered within an ongoing clinical network that provides a general form of feedback, aimed at improving and sustaining uptake of the revised pneumonia treatment policy. The objective was to determine whether an enhanced feedback intervention will improve correctness of classification and treatment of childhood pneumonia, compared to an existing approach to feedback, after nationwide treatment policy change and within an existing hospital network. Methods/design: A pragmatic, cluster randomized trial conducted within a clinical network of 12 Kenyan county referral hospitals providing inpatient pediatric care to children (aged 2–59 months) with acute medical conditions between March and November 2016. The intervention comprised enhanced feedback (monthly written feedback incorporating goal setting, and action planning delivered by a senior clinical coordinator for selected pneumonia indicators) and this was compared to standard feedback (2-monthly written feedback on multiple quality of pediatric care indicators) both delivered within a clinical network promoting clinical leadership linked to mentorship and peer-to-peer support, and improved use of health information on service delivery. The 12 hospitals were randomized to receive either enhanced feedback (n = 6) or standard feedback (n = 6) delivered over a 9-month period following nationwide pneumonia treatment policy change. The primary outcome is the proportion of all admitted patients with pneumonia (fulfilling criteria for treatment with orally administered amoxicillin) who are correctly classified and treated in the first 24 h. The secondary outcome will be measured over the course of the admission as any change in treatment for pneumonia after the first 24 h. Discussion: This trial protocol employs a pragmatic trial design during a period of nationwide change in treatment guidelines to address two high-priority areas within implementation research: promoting adoption of health policies and optimizing effectiveness of feedback.

123. Antimicrobial resistance of *Klebsiella pneumoniae* stool isolates circulating in Kenya.

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ABSTRACT

We sought to determine the genetic and phenotypic antimicrobial resistance (AMR) profiles of commensal *Klebsiella* spp. circulating in Kenya by testing human stool isolates of 87 *K. pneumoniae* and three *K. oxytoca* collected at eight locations. Over one-third of the isolates were resistant to ≥ 3 categories of antimicrobials and were considered multidrug-resistant (MDR). We then compared the resistance phenotype to the presence/absence of 238 AMR genes determined by a broad-spectrum microarray and PCR. Forty-six genes/gene families were identified conferring resistance to β -lactams (*ampC/blaDHA*, *blaCMY/LAT*, *blaLEN-1*, *blaOKP-A/OKP-B1*, *blaOXA-1*-like family, *blaOXY-1*, *blaSHV*, *blaTEM*, *blaCTX-M-1* and *blaCTX-M-2* families), aminoglycosides (*aac(3)-III*, *aac(6)-Ib*, *aad(A1/A2)*, *aad(A4)*, *aph(AI)*, *aph3/str(A)*, *aph6/str(B)*, and *rmtB*), macrolides (*mac(A)*, *mac(B)*, *mph(A)/mph(K)*), tetracyclines (*tet(A)*, *tet(B)*, *tet(D)*, *tet(G)*), ansamycins (*arr*), phenicols (*catA1/cat4*, *floR*, *cmlA*, *cmr*), fluoroquinolones (*qnrS*), quaternary amines (*qacE Δ 1*), streptothricin (*sat2*), sulfonamides (*sul1*, *sul2*, *sul3*), and diaminopyrimidines (*dfrA1*, *dfrA5*, *dfrA7*, *dfrA8*, *dfrA12*, *dfrA13/21/22/23* family, *dfrA14*, *dfrA15*, *dfrA16*, *dfrA17*). This is the first profile of genes conferring resistance to multiple categories of antimicrobial agents in western and central Kenya. The large number and wide variety of resistance genes detected suggest the presence of significant selective pressure. The presence of five or more resistance determinants in almost two-thirds of the isolates points to the need for more effective, targeted public health policies and infection control/prevention measures.

124. Comparative effectiveness of injectable penicillin versus a combination of penicillin and gentamicin in children with pneumonia characterised by indrawing in Kenya: a retrospective observational study.

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ABSTRACT

OBJECTIVES: Kenyan guidelines for antibiotic treatment of pneumonia recommended treatment of pneumonia characterised by in drawing with injectable penicillin alone in inpatient settings until early 2016. At this point, they were revised becoming consistent with WHO guidance after results of a Kenyan trial provided further evidence of equivalence of oral amoxicillin and injectable penicillin. This change also made possible use of oral amoxicillin for outpatient treatment in this patient group. However, given non-trivial mortality in Kenyan children with in drawing pneumonia, it remained possible they would benefit from a broader spectrum antibiotic regimen. Therefore, we compared the effectiveness of injectable penicillin monotherapy with a regimen combining penicillin with gentamicin. **Setting** We used a large routine observational dataset that captures data on all admissions to 13 Kenyan county hospitals. **Participants and measures.** The analyses included children aged 2–59 months. **Selection of study population** was based on inclusion criteria typical of a prospective trial, primary analysis (experiment 1, n=4002), but we also explored more pragmatic inclusion criteria (experiment 2, n=6420) as part of a secondary analysis. To overcome the challenges associated with the non-random allocation of treatments and missing data, we used propensity score (PS) methods and multiple imputation to minimise bias. Further, we estimated mortality risk ratios using log binomial regression and conducted sensitivity analyses using an instrumental variable and PS trimming **Results.** The estimated risk of dying, in experiment 1, in those receiving penicillin plus gentamicin was 1.46 (0.85 to 2.43) compared with the penicillin monotherapy group. In experiment 2, the estimated risk was 1.04(0.76 to 1.40).

CONCLUSION There is no statistical difference in the treatment of in drawing pneumonia with either penicillin or penicillin plus gentamicin. By extension, it is unlikely that treatment with penicillin plus gentamicin would offer an advantage to treatment with oral amoxicillin.

125. High Viremia and Wasting Before Antiretroviral Therapy Are Associated With Pneumonia in Early-Treated HIV-Infected Kenyan Infants.

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J Pediatric Infect Dis Soc. 2017 Sep 1;6(3):245-252. doi: 10.1093/jpids/piw038. PMID: 27481854; PMCID: PMC5907857.

ABSTRACT

BACKGROUND: Human immunodeficiency virus (HIV)-infected children are particularly susceptible to acute respiratory infections (ARIs). We determined incidence and cofactors for ARIs in HIV-infected infants receiving antiretroviral therapy (ART).

METHODS: Human immunodeficiency virus-infected infants initiated ART at ≤12 months of age and were observed monthly for 2 years in Nairobi. Acute respiratory infection rates and cofactors were determined using Andersen-Gill models, allowing for multiple events per infant.

RESULTS: Among 111 HIV-infected infants, median age at ART initiation was 4.5 months. Pre-ART median CD4% was 19%, and 29% had wasting. During 24-months follow-up while on ART, upper respiratory infection (URI) and pneumonia rates were 122.6 and 34.7 per 100 person-years (py), respectively. Infants with higher pre-ART viral load (VL) (plasma HIV ribonucleic acid [RNA] $\geq 7 \log_{10}$ copies/mL) had 4.12-fold increased risk of pneumonia (95% confidence interval [CI], 2.17–7.80), and infants with wasting (weight-for-height z-score < -2) had 2.87-fold increased risk (95% CI, 1.56–5.28). Infants with both high pre-ART VL and wasting had a higher pneumonia rate (166.8 per 100 py) than those with only 1 of these risk factors (44.4 per 100 py) or neither (17.0 per 100 py). Infants with exposure to wood fuel had significantly higher risk of URI (hazard ratio [HR] = 1.82; 95% CI, 1.44–2.28) and pneumonia (HR = 3.31; 95% CI, 1.76–6.21).

CONCLUSIONS: In early ART-treated HIV-infected infants, higher HIV RNA and wasting before ART were independent risk factors for pneumonia. Wood fuel use was associated with URI and pneumonia. Additional data on air pollution and respiratory outcomes in HIV-infected children may help optimize interventions to improve their lung health.

126. Risk factors for community-acquired pneumonia among adults in Kenya: a case-control study.

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Pneumonia (Nathan). 2017 Nov 25; 9:17. doi: 10.1186/s41479-017-0041-2. PMID: 29209590; PMCID: PMC5702239.

ABSTRACT

BACKGROUND: Pneumonia is a leading cause of morbidity and mortality among adults worldwide; however, the risk factors for community-acquired pneumonia in Africa are not well characterized.

METHODS: The authors recruited 281 cases of community-acquired pneumonia and 1202 hospital controls among patients aged ≥ 15 years who attended Kilifi District Hospital/Coast Provincial General Hospital in Kenya between 1994 and 6. Cases were admissions with an acute illness with ≥ 2 respiratory signs and evidence of consolidation on a chest radiograph. Controls were patients without signs of pneumonia, frequency matched by age, sex and hospital. Risk factors related to socio-demographic factors, drug use, clinical history, contact patterns and exposures to indoor air pollution were investigated by questionnaire, anthropometric measurements and laboratory assays. Associations were evaluated using a hierarchical logistic regression model.

RESULTS: Pneumonia was associated with human immunodeficiency virus (HIV) infection (Odds Ratio [OR] 2.06, 95% CI 1.44–3.08), anemia (OR 1.91, 1.31–2.74), splenomegaly (OR 2.04, 95% CI 1.14–3.41), recent history of pneumonia (OR 4.65, 95% CI 1.66–12.5), history of pneumonia >2 years previously (OR 17.13, 95% CI 5.01–60.26), coryza in the 2 weeks preceding hospitalization (OR 2.09, 95% CI 1.44–3.03), current smoking (2.19, 95% CI 1.39–3.70), use of khat (OR 3.44, 95% CI 1.72–7.15), use of snuff (OR 2.67, 95% CI 1.35–5.49) and contact with several animal species. Presence of a Bacillus Calmette-Guerin (BCG) scar was associated with protection (OR 0.51, 95% CI 0.32–0.82). The risk factors varied significantly by sex.

CONCLUSION: Pneumonia in Kenyan adults was associated with global risk factors, such as HIV and smoking, but also with specific local factors like drug use and contact with animals. Intervention strategies should account for sex-specific differences in risk factors.

127. Modelling and optimal control of pneumonia disease with cost-effective strategies.

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J Biol Dyn. 2017 Aug;11(sup2):400-426. doi: 10.1080/17513758.2017.1337245. Epub 2017 Jun 14. PMID: 28613986.

ABSTRACT

We propose and analyse a nonlinear mathematical model for the transmission dynamics of pneumonia disease in a population of varying size. The deterministic compartmental model is studied using stability theory of differential equations. The effective reproduction number is obtained and also the asymptotic stability conditions for the disease free and as well as for the endemic equilibria are established. The possibility of bifurcation of the model and the sensitivity indices of the basic reproduction number to the key parameters are determined. Using Pontryagin's maximum principle, the optimal control problem is formulated with three control strategies: namely disease prevention through education, treatment and screening. The cost-effectiveness analysis of the adopted control strategies revealed that the combination of prevention and treatment is the most cost-effective intervention strategies to combat the pneumonia pandemic. Numerical simulation is performed and pertinent results are displayed graphically.

128. High Prevalence of Multi-Drug Resistant *Klebsiella pneumoniae* in a Tertiary Teaching Hospital in Western Kenya.

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ABSTRACT

INTRODUCTION: *Klebsiella pneumoniae* is a gram negative enterobacteriaceae commonly associated with nosocomial infections. Multidrug resistant strains are increasingly being reported with corresponding increase in morbidity and mortality. The study outlines the epidemiology and antibiotic resistance pattern of *K. pneumoniae* over a 10 year period in Moi Teaching and Referral Hospital, Eldoret, Kenya.

METHODOLOGY AND STUDY DESIGN: This is a retrospective analysis of all the blood culture results for *K. pneumoniae* isolates in the hospital for the period 2002-2013. Results: *K. pneumoniae* accounted for 23% of the hospital isolates (231/1356) during the study period; of these, 82.6% were from the New Born Unit. Most of the isolates were multi drug resistant with highest resistance of over 80% to Penicillins, Cephalosporins, Macrolides, Tetracyclines, Sulphonamides, Lincosamides and Chloramphenicol. Aminoglycoside and Quinolone resistance was also high at 49.2% and 41.3% respectively. The lowest resistance rates were documented for Carbapenems (23.2%). For specific antibiotics, there was high resistance to commonly used antibiotics (over 80% for Ceftriaxone, Cefipime, Gentamycin and Ceftazidime). The antibiotics with least resistance were Amikacin and Meropenem (21% and 7 % respectively).

CONCLUSION: There was a high prevalence of multidrug resistant *K. pneumoniae* isolates in the hospital, the majority originated from the New Born Unit. Resistance to third generation Cephalosporins and Gentamycin was high while Meropenem and Amikacin had the least resistance.

129. Perceived Quality of Care of Community Health Worker and Facility-Based Health Worker Management of Pneumonia in Children Under 5 Years in Western Kenya: A Cross-Sectional Multidimensional Study.

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Am J Trop Med Hyg. 2016 May 4;94(5):1170-6. doi: 10.4269/ajtmh.15-0784. Epub 2016 Mar 14 PMID: 26976883; PMCID: PMC4856619.

ABSTRACT

Integrated community case management (iCCM) programs that train lay community health workers (CHWs) in the diagnosis and treatment of diarrhea, malaria, and pneumonia have been increasingly adopted throughout sub-Saharan Africa to provide services in areas where accessibility to formal public sector health services is low. One important aspect of successful iCCM programs is the acceptability and utilization of services provided by CHWs. To understand community perceptions of the quality of care in an iCCM intervention in western Kenya, we used the Primary Care Assessment Survey to compare caregiver attitudes about the diagnosis and treatment of childhood pneumonia as provided by CHWs and facility-based health workers (FBHWs). Overall, caregivers rated CHWs more highly than FBHWs across a set of 10 domains that capture multiple dimensions of the care process. Caregivers perceived CHWs to provide higher quality care in terms of accessibility and patient relationship and equal quality care on clinical aspects. These results argue for the continued implementation and scale-up of iCCM programs as an acceptable intervention for increasing access to treatment of childhood pneumonia.

130. Human metapneumovirus epidemiological and evolutionary patterns in Coastal Kenya,

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2007-11. BMC Infect Dis. 2016 Jun 17; 16:301. Doi: 10.1186/s12879-016-1605-0. PMID: 27316548; PMCID: PMC4912817.

ABSTRACT

BACKGROUND: Human metapneumovirus (HMPV) is an important global cause of severe acute respiratory infections in young children and the elderly. The epidemiology of HMPV in sub-Saharan Africa is poorly described and factors that allow its recurrent epidemics in communities not understood.

METHODS: We undertook paediatric inpatient surveillance for HMPV in Kilifi County Hospital (KCH) of Coastal Kenya between 2007 and 2011. Nasopharyngeal samples collected from children aged 1 day–59 months admitted with severe or very severe pneumonia, were tested for HMPV using real-time polymerase chain reaction (RT-PCR). Partial nucleotide sequences of the

attachment (G) and fusion (F) surface proteins of positive samples were determined and phylogenetically analyzed.

RESULTS: HMPV was detected in 4.8 % (160/3320) of children [73.8 % (118/160) of these less than one year of age], ranging between 2.9 and 8.8 % each year over the 5 years of study. HMPV infections were seasonal in occurrence, with cases predominant in the months of November through April. These months frequently coincided with low rainfall, high temperature and low relative humidity in the location. Phylogenetic analysis of partial F and G sequences revealed three subgroups of HMPV, A2 (74 %, 91/123), B1 (3.2 %, 4/123) and B2 (22.8 %, 28/123) in circulation, with subgroup A2 predominant in majority of the epidemic seasons. Comparison of G sequences (local and global) provided a greater phylogenetic resolution over comparison of F sequences and indicated presence of probable multiple G antigenic variants within the subgroups due to differences in amino acid sequence, encoded protein length and glycosylation patterns.

CONCLUSION: The present study reveals HMPV is an important seasonal contributor to respiratory disease hospitalization in coastal Kenya, with an evolutionary pattern closely relating to that of respiratory syncytial virus.

131. Comparison of Severe Acute Respiratory Illness (SARI) and clinical pneumonia case definitions for the detection of influenza virus infections among hospitalized patients, western Kenya, 2009-2013.

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Influenza Other Respir Viruses. 2016 Jul;10(4):333-9. doi: 10.1111/irv.12382. Epub 2016 Mar 23. PMID: 27219455; PMCID: PMC4910169.

ABSTRACT

Although the severe acute respiratory illness (SARI) case definition is increasingly used for inpatient influenza surveillance, pneumonia is a more familiar term to clinicians and policymakers. We evaluated WHO case definitions for severe acute respiratory illness (SARI) and pneumonia (Integrated Management of Childhood Illnesses (IMCI) for children aged <5 years and Integrated Management of Adolescent and Adult Illnesses (IMAI) for patients aged ≥13 years) for detecting laboratory-confirmed influenza among hospitalized ARI patients. Sensitivities were 84% for SARI and 69% for IMCI pneumonia in children aged <5 years and 60% for SARI and 57% for IMAI pneumonia in patients aged ≥13 years. Clinical pneumonia case definitions may be a useful complement to SARI for inpatient influenza surveillance.

132. Factors associated with adherence to diarrhea case management guidelines for children aged <5 years in siaya county, Western Kenya, 2015-2017

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ABSTRACT

BACKGROUND: Diarrhea is a leading cause of morbidity and mortality among children aged <5 years. Factors associated with adherence to the WHO guidelines on treatment of diarrhea are not well documented in sub-Saharan Africa. We assessed factors associated with adherence to the WHO guidelines on management of diarrhea in rural western Kenya.

METHODS: We enrolled children with moderate-severe diarrhea (MSD) participating in the Vaccine Impact on Diarrhea Assessment in Africa (VIDA) from July 2015 to July 2017. An MSD case was defined as a child with a diarrheal illness <7 days duration comprising ≥ 3 loose stools in 24 hrs and ≥ 1 of the following: sunken eyes, skin tenting, dysentery, IV rehydration, dysentery or hospitalization. Adherence was defined as ORS and zinc given for moderate dehydration; ORS, Zinc and Intravenous fluids given for children with severe dehydration or antibiotics for dysentery, pneumonia or other bacterial infection in the diarrhea case management. Logistic regression was used to determine factors associated with adherence.

RESULTS: 1,129 children had MSD of which 903/1,129 (80%) met criteria for adherence to the WHO guidelines. Majority 482 (53.4 %) were males. Children who presented with normal skin turgor (aOR=4.98, p<0.001), dysentery (aOR= 9.43, p=0.002) and malaria (aOR=2.56, p<0.001) were more likely to be managed in adherence to the WHO guidelines and were more likely to be managed by clinical officers (aOR=1.41, p=0.036).

CONCLUSION: Overall, most MSD cases were managed according to the WHO guidelines especially among those with severe disease. Despite the good adherence there is need to bridge the gap of non-adherence

133. High levels of multidrug resistance Enterobacteriaceae from clinical isolates from Kenyan public hospitals

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ABSTRACT

INTRODUCTION: *Klebsiella pneumoniae*, *E. coli* and *Enterobacter* spp are gram negative lactose fermenting bacteria classified as Enterobacteriaceae. Multidrug resistant Enterobacteriaceae (MDRE) are typically associated with extended spectrum beta lactamase (ESBL) production leading to cephalosporin resistance and carbapenemase production resulting in carbapenem drug resistance. These resistance patterns present a treatment challenge as they are associated with resistance to first line drugs in the fluoroquinolone, tetracycline, phenicol and aminoglycoside classes. The last-line treatment for carbapenem-resistant MDRE is colistin. The emergence and spread of plasmid mediated colistin resistance globally has further exacerbated the problem of MDRE. Antibiotic resistance trends in these bacteria are not closely monitored in developing countries in sub-Saharan Africa leaving the threat of MDREs largely undefined.

METHODS: A hospital-based antimicrobial resistance surveillance study has been running since 2015 in Nairobi, Kisumu, Malindi and Kericho. Patients with symptoms of bacterial infections of the throat, urine, blood, and skin and soft tissue are eligible for enrollment. Samples are obtained and sent to CMR/KEMRI where isolation, identification and antimicrobial susceptibility tests are performed on a VITEK2 platform.

RESULTS: In this period 26/88 (30%) extended spectrum beta-lactamase producing (ESBL) *E. coli* isolates were detected. The *E. coli* isolates showed reduced susceptibility (<80%) to 23/31 of the drugs tested. Notable resistance patterns were 13 colistin and 6 carbapenem resistant isolates. *Klebsiella pneumoniae* isolates exhibited high levels of multidrug resistance with 26/30 (86%) isolates showing <80% susceptibility to a majority of drugs tested. MDR *K. pneumoniae* isolates showed >80% susceptibility to only colistin, tigecycline and Carbapenems. Two carbapenem and 1 colistin resistant *K. pneumoniae* isolate(s) were detected. *Enterobacter* spp. had relatively low levels of resistance with isolates being completely susceptible to 8 drugs and >80% susceptibility to 16/31 drugs. Only 3 MDR isolates were observed with 1 of the isolates being XDR i.e., resistant to all 19 drugs it was tested against, including Carbapenems.

CONCLUSIONS: There was a high frequency of ESBL and MDR phenotypes among the Enterobacteriaceae isolates with reduced susceptibility to a large number of 1st and 2nd line antibiotics. The isolates with carbapenem and colistin resistance, last-line drugs for treatment of gram-negative infections and the XDR *K. pneumoniae* isolate, portends an era of untreatable bacterial infections. To curb this trend, continued monitoring, rational drug use and sparing use of last-line drugs such as Carbapenems and colistin is recommended to conserve antibiotic efficacy.

134. **Pertussis-Associated Pneumonia in Infants and Children From Low- and Middle-Income Countries Participating in the PERCH Study.**

Barger-Kamate B, Deloria Knoll M, Kagucia EW, Prospero C, Baggett HC, Brooks WA, Feikin DR, Hammit LL, Howie SR, Levine OS, Madhi SA, Scott JA, Thea DM, Amornintapichet T, Anderson TP, Awori JO, Baillie VL, Chipeta J, DeLuca AN, Driscoll AJ, Goswami D, Higdon

MM, Hossain L, Karron RA, Maloney S, Moore DP, Morpeth SC, Mwananyanda L, Ofordile O, Olutunde E, Park DE, Sow SO, Tapia MD, Murdoch DR, O'Brien KL, Kotloff KL;

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ABSTRACT

BACKGROUND: Few data exist describing pertussis epidemiology among infants and children in low- and middle-income countries to guide preventive strategies.

METHODS: Children 1–59 months of age hospitalized with World Health Organization–defined severe or very severe pneumonia in 7 African and Asian countries and similarly aged community controls were enrolled in the Pneumonia Etiology Research for Child Health study. They underwent a standardized clinical evaluation and provided nasopharyngeal and oropharyngeal

swabs and induced sputum (cases only) for *Bordetella pertussis* polymerase chain reaction. Risk factors and pertussis-associated clinical findings were identified.

RESULTS: *Bordetella pertussis* was detected in 53 of 4200 (1.3%) cases and 11 of 5196 (0.2%) controls. In the age stratum 1–5 months, 40 (2.3% of 1721) cases were positive, all from African sites, as were 8 (0.5% of 1617) controls. Pertussis-positive African cases 1–5 months old, compared to controls, were more often human immunodeficiency virus (HIV) uninfected-exposed (adjusted odds ratio [aOR], 2.2), unvaccinated (aOR, 3.7), underweight (aOR, 6.3), and too young to be immunized (aOR, 16.1) (all $P \leq .05$). Compared with pertussis-negative African cases in this age group, pertussis-positive cases were younger, more likely to vomit (aOR, 2.6), to cough ≥ 14 days (aOR, 6.3), to have leukocyte counts $>20\,000$ cells/ μL (aOR, 4.6), and to have lymphocyte counts $>10\,000$ cells/ μL (aOR, 7.2) (all $P \leq .05$). The case fatality ratio of pertussis-infected pneumonia cases 1–5 months of age was 12.5% (95% confidence interval, 4.2%–26.8%; 5/40); pertussis was identified in 3.7% of 137 in-hospital deaths among African cases in this age group.

CONCLUSIONS: In the postneonatal period, pertussis causes a small fraction of hospitalized pneumonia cases and deaths; however, case fatality is substantial. The propensity to infect unvaccinated infants and those at risk for insufficient immunity (too young to be vaccinated, premature, HIV-infected/exposed) suggests that the role for maternal vaccination should be considered along with efforts to reduce exposure to risk factors and to optimize childhood pertussis vaccination coverage.

136. Influence of age, severity of infection, and co-infection on the duration of Respiratory Syncytial Virus (RSV) shedding.

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Epidemiol Infect. 2015 Mar;143(4):804-12. doi: 10.1017/S0950268814001393. Epub 2014 Jun 5. PMID: 24901443; PMCID: PMC4411640.

ABSTRACT

RSV is the most important viral cause of pneumonia and bronchiolitis in children worldwide and has been associated with significant disease burden. With the renewed interest in RSV vaccines, we provide realistic estimates on duration, and influencing factors on RSV shedding which are required to better understand the impact of vaccination on the virus transmission dynamics. The data arise from a prospective study of 47 households (493 individuals) in rural Kenya, followed through a 6-month period of an RSV seasonal outbreak. Deep nasopharyngeal swabs were collected twice each week from all household members, irrespective of symptoms, and tested for RSV by multiplex PCR. The RSV G gene was sequenced. A total of 205 RSV infection episodes were detected in 179 individuals from 40 different households. The infection data were interval censored and assuming a random event time between observations, the average duration of virus

shedding was 11.2 (95% confidence interval 10.1–12.3) days. The shedding durations were longer than previous estimates (3.9–7.4 days) based on immunofluorescence antigen detection or viral culture, and were shown to be strongly associated with age, severity of infection, and revealed potential interaction with other respiratory viruses. These findings are key to our understanding of the spread of this important virus and are relevant in the design of control programmes.

137. Severe Pneumonia Study Group. Oral amoxicillin versus benzyl penicillin for severe pneumonia among Kenyan children: a pragmatic randomized controlled non-inferiority trial.

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Clinical Trial Registration. NCT01399723. Clin Infect Dis. 2015 Apr 15;60(8):1216-24. doi: 10.1093/cid/ciu1166. Epub 2014 Dec 30. PMID: 25550349; PMCID: PMC4370168.

ABSTRACT

BACKGROUND: There are concerns that the evidence from studies showing noninferiority of oral amoxicillin to benzyl penicillin for severe pneumonia may not be generalizable to high-mortality settings.

METHODS. An open-label, multicenter, randomized controlled noninferiority trial was conducted at 6 Kenyan hospitals. Eligible children aged 2–59 months were randomized to receive amoxicillin or benzyl penicillin and followed up for the primary outcome of treatment failure at 48 hours. A noninferiority margin of risk difference between amoxicillin and benzyl penicillin groups was prespecified at 7%.

RESULTS. We recruited 527 children, including 302 (57.3%) with comorbidity. Treatment failure was observed in 20 of 260 (7.7%) and 21 of 261 (8.0%) of patients in the amoxicillin and benzyl penicillin arms, respectively (risk difference, –0.3% [95% confidence interval, –5.0% to 4.3%]) in per-protocol analyses. These findings were supported by the results of intention-to-treat analyses. Treatment failure by day 5 postenrollment was 11.4% and 11.0% and rising to 13.5% and 16.8% by day 14 in the amoxicillin vs benzyl penicillin groups, respectively. The most frequent cause of cumulative treatment failure at day 14 was clinical deterioration within 48 hours of enrollment

(33/59 [55.9%]). Four patients died (overall mortality 0.8%) during the study, 3 of whom were allocated to the benzyl penicillin group. The presence of wheeze was independently associated with less frequent treatment failure.

CONCLUSIONS. Our findings confirm noninferiority of amoxicillin to benzyl penicillin, provide estimates of risk of treatment failure in Kenya, and offer important additional evidence for policy making in sub-Saharan Africa.

138. Ministry of Health Hospital Survey Group. Moving towards routine evaluation of quality of inpatient pediatric care in Kenya.

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PLoS One. 2015 Mar 30;10(3): e0117048. doi: 10.1371/journal.pone.0117048. PMID: 25822492; PMCID: PMC4378956.

ABSTRACT

BACKGROUND: Regular assessment of quality of care allows monitoring of progress towards system goals and identifies gaps that need to be addressed to promote better outcomes. We report efforts to initiate routine assessments in a low-income country in partnership with government.

METHODS: A cross-sectional survey undertaken in 22 'internship training' hospitals across Kenya that examined availability of essential resources and process of care based on review of 60 case-records per site focusing on the common childhood illnesses (pneumonia, malaria, diarrhea/dehydration, malnutrition and meningitis).

RESULTS: Availability of essential resources was 75% (45/61 items) or more in 8/22 hospitals. A total of 1298 (range 54–61) case records were reviewed. HIV testing remained suboptimal at 12% (95% CI 7–19). A routinely introduced structured pediatric admission record form improved documentation of core admission symptoms and signs (median score for signs 22/22 and 8/22 when form used and not used respectively). Correctness of penicillin and gentamicin dosing was above 85% but correctness of prescribed intravenous fluid or oral feed volumes for severe dehydration and malnutrition were 54% and 25% respectively. Introduction of Zinc for diarrhea

has been relatively successful (66% cases) but use of artesunate for malaria remained rare. Exploratory analysis suggests considerable variability of the quality of care across hospitals.

CONCLUSION: Quality of pediatric care in Kenya has improved but can improve further. The approach to monitoring described in this survey seems feasible and provides an opportunity for routine assessments across a large number of hospitals as part of national efforts to sustain improvement. Understanding variability across hospitals may help target improvement efforts.

139. Severe acute respiratory infection in children in a densely populated urban slum in Kenya, 2007-2011.

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BMC Infect Dis. 2015 Feb 25; 15:95. doi: 10.1186/s12879-015-0827-x. PMID: 25879805; PMCID: PMC4351931.

ABSTRACT

BACKGROUND: Reducing acute respiratory infection burden in children in Africa remains a major priority and challenge. We analyzed data from population-based infectious disease surveillance for severe acute respiratory illness (SARI) among children <5 years of age in Kibera, a densely populated urban slum in Nairobi, Kenya.

METHODS: Surveillance was conducted among a monthly mean of 5,874 (range = 5,778-6,411) children <5 years old in two contiguous villages in Kibera. Participants had free access to the study clinic and their health events and utilization were noted during biweekly home visits. Patients meeting criteria for SARI (WHO-defined severe or very severe pneumonia, or oxygen saturation <90%) from March 1, 2007-February 28, 2011 had blood cultures processed for bacteria, and naso- and oro- pharyngeal swabs collected for quantitative real-time reverse transcription polymerase chain reaction testing for influenza viruses, parainfluenza viruses (PIV), respiratory syncytial virus (RSV), adenovirus, and human metapneumovirus (hMPV). Swabs collected during January 1, 2009 – February 28, 2010 were also tested for rhinoviruses, enterovirus, parechovirus, *Mycoplasma pneumoniae*, and *Legionella* species. Swabs were collected for simultaneous testing from a selected group of control-children visiting the clinic without recent respiratory or diarrheal illnesses.

RESULTS: SARI overall incidence was 12.4 cases/100 person-years of observation (PYO) and 30.4 cases/100 PYO in infants. When comparing detection frequency in swabs from 815 SARI cases and 115 healthy controls, only RSV and influenza A virus were significantly more frequently detected in cases, although similar trends neared statistical significance for PIV, adenovirus and hMPV. The incidence for RSV was 2.8 cases/100 PYO and for influenza A was 1.0 cases/100 PYO. When considering all PIV, the rate was 1.1 case/100 PYO and the rate per 100 PYO for SARI-associated disease was 1.5 for adenovirus and 0.9 for hMPV. RSV and influenza A and B viruses were estimated to account for 16.2% and 6.7% of SARI cases, respectively; when taken together, PIV, adenovirus, and hMPV may account for >20% additional cases.

CONCLUSIONS: Influenza viruses and RSV (and possibly PIV, hMPV and adenoviruses) are important pathogens to consider when developing technologies and formulating strategies to treat and prevent SARI in children.

140. Etiologies of bacteremia from a population-based surveillance in rural and urban Kenya, 2006-2014

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ABSTRACT

BACKGROUND: Knowledge of the spectrum of bacterial infectious pathogens is important for informing appropriate diagnostic, therapeutic and preventative interventions. However, data on etiologies of blood stream infections in Africa are limited. Methods: We sought to determine the causes of bacteremia among >50,000 participants in a population-based surveillance in Asembo, a rural setting in western Kenya, and Kibera, an informal settlement in Nairobi, Kenya. Blood culture specimens were obtained from participants presenting with acute lower respiratory tract illness, jaundice, or acute febrile illness to a designated outpatient facility in each site, or any hospital admission for a potentially infectious cause (Asembo only). Results: Among 3559 blood cultures performed, 42% had no growth, 793 (22%) grew a contaminant, and 1273 (36%) yielded a pathogen. Among 542 pathogens detected in Asembo, the most common was non-Typhi Salmonella (NTS) (45% overall, 64% among children <5 years, 36% among those ≥5 years), followed by Streptococcus pneumoniae (34% overall, 18 % among <5 years, 42% among ≥5 years). In Kibera 731 pathogens were isolated; Salmonella typhi was the most frequent across all ages (47% overall, 37% among children <5 years, 53% among ≥5 years), followed by S. pneumoniae (18% overall and among both age groups). In Kibera NTS was common in children <5 years (20%), while less frequently found in those ≥5 years (6%). Staphylococcus aureus was isolated in 16% of all positive cultures in Kibera, but only 4.8% in Asembo. Conclusion: Etiologies of bacteremia differ between the rural and urban settings and across the various age groups. Two

major pathogens detected (*S. typhi* and *S. pneumoniae*) are vaccine-preventable; introduction of the pneumococcal conjugate vaccine during the study period likely affected the burden of pneumococcal disease observed, particularly among young children. Vaccination against typhoid (and NTS were a vaccine available) could further reduce bacteremia in Kenya.

141. Childhood cause-specific mortality in rural Western Kenya: application of the InterVA-4 model.

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Glob Health Action. 2014 Oct 29; 7:25581. doi: 10.3402/gha.v7.25581. PMID: 25377340; PMCID: PMC4221497.

ABSTRACT

BACKGROUND: Assessing the progress in achieving the United Nation's Millennium Development Goals in terms of population health requires consistent and reliable information on cause-specific mortality, which is often rare in resource-constrained countries. Health and demographic surveillance systems (HDSS) have largely used medical personnel to review and assign likely causes of death based on the information gathered from standardized verbal autopsy (VA) forms. However, this approach is expensive and time consuming, and it may lead to biased results based on the knowledge and experience of individual clinicians. We assessed the cause-specific mortality for children under 5 years old (under-5 deaths) in Siaya County, obtained from a computer-based probabilistic model (InterVA-4).

DESIGN: Successfully completed VA interviews for under-5 deaths conducted between January 2003 and December 2010 in the Kenya Medical Research Institute/US Centers for Disease Control and Prevention HDSS were extracted from the VA database and processed using the InterVA-4 (version 4.02) model for interpretation. Cause-specific mortality fractions were then generated from the causes of death produced by the model.

RESULTS: A total of 84.33% (6,621) childhood deaths had completed VA data during the study period. Children aged 1–4 years constituted 48.53% of all cases, and 42.50% were from infants. A single cause of death was assigned to 89.18% (5,940) of cases, 8.35% (556) of cases were assigned two causes, and 2.10% (140) were assigned 'indeterminate' as cause of death by the InterVA-4 model. Overall, malaria (28.20%) was the leading cause of death, followed by acute respiratory infection including pneumonia (25.10%), in under-5 children over the study period. But in the first 5 years of the study period, acute respiratory infection including pneumonia was the main cause of death, followed by malaria. Similar trends were also reported in infants (29 days–11 months) and children aged 1–4 years.

CONCLUSIONS: Under-5 cause-specific mortality obtained using the InterVA-4 model is consistent with existing knowledge on the burden of childhood diseases in rural western Kenya.

142. Discovery and validation of biomarkers to guide clinical management of pneumonia in African children.

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Clin Infect Dis. 2014 Jun; 58(12):1707-15. doi: 10.1093/cid/ciu202. Epub 2014 Apr 2. PMID: 24696240; PMCID: PMC4036688.

ABSTRACT

BACKGROUND: Pneumonia is the leading cause of death in children globally. Clinical algorithms remain suboptimal for distinguishing severe pneumonia from other causes of respiratory distress such as malaria or distinguishing bacterial pneumonia and pneumonia from other causes, such as viruses. Molecular tools could improve diagnosis and management.

METHODS. We conducted a mass spectrometry-based proteomic study to identify and validate markers of severity in 390 Gambian children with pneumonia (n = 204) and age-, sex-, and neighborhood-matched controls (n = 186). Independent validation was conducted in 293 Kenyan children with respiratory distress (238 with pneumonia, 41 with *Plasmodium falciparum* malaria, and 14 with both). Predictive value was estimated by the area under the receiver operating characteristic curve (AUC).

RESULTS. Lipocalin 2 (Lpc-2) was the best protein biomarker of severe pneumonia (AUC, 0.71 [95% confidence interval, .64–.79]) and highly predictive of bacteremia (78% [64%–92%]), pneumococcal bacteremia (84% [71%–98%]), and “probable bacterial etiology” (91% [84%–98%]). These results were validated in Kenyan children with severe malaria and respiratory distress who also met the World Health Organization definition of pneumonia. The combination of Lpc-2 and haptoglobin distinguished bacterial versus malaria origin of respiratory distress with high sensitivity and specificity in Gambian children (AUC, 99% [95% confidence interval, 99%–100%]) and Kenyan children (82% [74%–91%]).

CONCLUSIONS. Lpc-2 and haptoglobin can help discriminate the etiology of clinically defined pneumonia and could be used to improve clinical management. These biomarkers should be further evaluated in prospective clinical studies.

143. Local barriers and solutions to improve care-seeking for childhood pneumonia, diarrhea and malaria in Kenya, Nigeria and Niger: a qualitative study.

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PLoS One. 2014 Jun 27;9(6): e100038. doi: 10.1371/journal.pone.0100038. PMID: 24971642; PMCID: PMC4074042.

ABSTRACT

We present qualitative research findings on care-seeking and treatment uptake for pneumonia, diarrhea and malaria among children under 5 in Kenya, Nigeria and Niger. The study aimed to determine the barriers caregivers face in accessing treatment for these conditions; to identify local solutions that facilitate more timely access to treatment; and to present these findings as a platform from which to develop context-specific strategies to improve care-seeking for childhood illness. Kenya, Nigeria and Niger are three high burden countries with low rates of related treatment coverage, particularly in underserved areas. Data were collected in Homa Bay County in Nyanza Province, Kenya; in Kebbi and Cross River States, Nigeria; and in the Maradi and Tillabéri regions of Niger. Primary caregivers of children under 5 who did not regularly engage with health services or present their child at a health facility during illness episodes were purposively selected for interview. Data underwent rigorous thematic analysis. We organise the identified barriers and related solutions by theme: financial barriers; distance/location of health facilities; socio-cultural barriers and gender dynamics; knowledge and information barriers; and health facility deterrents. The relative importance of each differed by locality. Participant suggested solutions ranged from community-level actions to facility-level and more policy-oriented actions, plus actions to change underlying problems such as social perceptions and practices and gender dynamics. We discuss the feasibility and implications of these suggested solutions. Given the high burden of childhood morbidity and mortality due to pneumonia, diarrhea and malaria in Kenya, Nigeria and Niger, this study provides important insights relating to demand-side barriers and locally proposed solutions. Significant advancements are possible when communities participate in both problem identification and resolution, and are engaged as important partners in improving child health and survival.

144. Population genetic structure of *Streptococcus pneumoniae* in Kilifi, Kenya, prior to the introduction of pneumococcal conjugate vaccine.

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PLoS One. 2013 Nov 25;8(11): e81539. doi: 10.1371/journal.pone.0081539. PMID: 24282605; PMCID: PMC3839905.

ABSTRACT

BACKGROUND: The 10-valent pneumococcal conjugate vaccine (PCV10) was introduced in Kenya in 2011. Introduction of any PCV will perturb the existing pneumococcal population structure, thus the aim was to genotype pneumococci collected in Kilifi before PCV10.

METHODS AND FINDINGS: Using multilocus sequence typing (MLST), we genotyped >1100 invasive and carriage pneumococci from children, the largest collection genotyped from a single resource-poor country and reported to date. Serotype 1 was the most common serotype causing invasive disease and was rarely detected in carriage; all serotype 1 isolates were members of clonal complex (CC) 217. There were temporal fluctuations in the major circulating sequence types (STs); and although 1-3 major serotype 1, 14 or 23F STs co-circulated annually, the two major serotype 5 STs mainly circulated independently. Major STs/CCs also included isolates of serotypes 3, 12F, 18C and 19A and each shared ≤ 2 MLST alleles with STs that circulate widely elsewhere. Major CCs associated with non-PCV10 serotypes were predominantly represented by carriage isolates, although serotype 19A and 12F CCs were largely invasive and a serotype 10A CC was equally represented by invasive and carriage isolates.

CONCLUSIONS: Understanding the pre-PCV10 population genetic structure in Kilifi will allow for the detection of changes in prevalence of the circulating genotypes and evidence for capsular switching post-vaccine implementation.

145. Impact of locally-produced, ceramic cookstoves on respiratory disease in children in rural western Kenya

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Am J Trop Med Hyg. 2013 Jan;88(1):132-7. doi: 10.4269/ajtmh.2012.12-0496. Epub 2012 Dec 12. PMID: 23243108; PMCID: PMC3541723.

ABSTRACT

Household air pollution is a risk factor for pneumonia, the leading cause of death among children < 5 years of age. From 2008 to 2010, a Kenyan organization sold ~2,500 ceramic cookstoves (upesi jiko) that produce less visible household smoke than 3-stone firepits. During a year-long observational study, we made 25 biweekly visits to 200 homes to determine stove use and observe signs of acute respiratory infection in children < 3 years of age. Reported stove use included 3-stone firepit only (81.8%), upesi jiko only (15.7%), and both (2.3%). Lower, but not statistically significant, percentages of children in upesi jiko-using households than 3-stone firepit-using households had observed cough (1.3% versus 2.9%, rate ratio [RR] 0.48, 95% confidence interval [CI]: 0.22–1.03), pneumonia (0.9% versus 1.7%, RR 0.60, 95% CI: 0.24–1.48), and severe pneumonia (0.3% versus 0.6%, RR 0.66, 95% CI: 0.17–2.62). Upesi jiko use did not result in significantly lower pneumonia rates. Further research on the health impact of improved cookstoves is warranted.

146. **Breastfeeding is associated with decreased pneumonia incidence among HIV-exposed, uninfected Kenyan infants.**

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AIDS. 2013 Nov 13;27(17):2809-15. doi: 10.1097/01.aids.0000432540.59786.6d. PMID: 23921609; PMCID: PMC4084504.

ABSTRACT

OBJECTIVE: HIV-exposed uninfected infants (HEU) have higher infectious disease morbidity and mortality than unexposed infants. We determined the incidence and risk factors for pneumonia, a leading cause of infant mortality worldwide, in a cohort of HEU infants. Identifying predictors of pneumonia among HEU infants may enable early identification of those at highest risk. **Design:** A retrospective cohort of HEU participating in a Kenyan perinatal HIV study, enrolled between 1999-2002.

METHODS: Infants were followed monthly from birth to 12 months. Incidence of pneumonia diagnosed at monthly study visits, sick-child visits or by means of a verbal autopsy, was estimated with a 14-day window for new episodes. Cox proportional hazards regression was used to identify predictors of first pneumonia occurrence.

RESULTS: Among 388 HEU infants with 328 person-years of follow-up, the incidence of pneumonia was 900/1,000 child-years (95% CI: 800-1,000). Maternal HIV viral load at 32 weeks gestation [HR=1.2 (1.0-1.5) per log₁₀ difference] and being underweight (weight-for-age Z-score <-2) at the previous visit [HR=1.8 (1.1-2.8)] were associated with increased risk of pneumonia. Breastfed infants had a 47% lower risk of pneumonia than those never breastfed [HR=0.53 (0.39-0.73)], independent of infant growth, maternal viral load and maternal CD4%. Breastfeeding was also associated with a 74% lower risk of pneumonia-related hospitalization (HR=0.26 (0.13-0.53)).

CONCLUSIONS: The incidence of pneumonia in this cohort of HEU infants was high. Our observations suggest that maternal viral suppression and breastfeeding may reduce the burden of pneumonia among HEU

147. Assessment of health benefits and cost-effectiveness of 10-valent and 13-valent pneumococcal conjugate vaccination in Kenyan children.

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PLoS One. 2013 Jun 24;8(6): e67324. doi: 10.1371/journal.pone.0067324. PMID: 23826268; PMCID: PMC3691111.

ABSTRACT

BACKGROUND: The GAVI Alliance supported 10-valent pneumococcal conjugate vaccine (PCV10) introduction in Kenya. We estimated the cost-effectiveness of introducing either PCV10 or the 13-valent vaccine (PCV13) from a societal perspective and explored the incremental impact of including indirect vaccine effects.

METHODS: The costs and effects of pneumococcal vaccination among infants born in Kenya in 2010 were assessed using a decision analytic model comparing PCV10 or PCV13, in turn, with no vaccination. Direct vaccine effects were estimated as a reduction in the incidence of pneumococcal meningitis, sepsis, bacteraemic pneumonia and non-bacteraemic pneumonia.

Pneumococcal disease incidence was extrapolated from a population-based hospital surveillance system in Kilifi and adjustments were made for variable access to care across Kenya. We used vaccine efficacy estimates from a trial in The Gambia and accounted for serotype distribution in Kilifi. We estimated indirect vaccine protection and serotype replacement by extrapolating from the USA. Multivariable sensitivity analysis was conducted using Monte Carlo simulation. We assumed a vaccine price of US\$ 3.50 per dose.

FINDINGS: The annual cost of delivering PCV10 was approximately US\$14 million. We projected a 42.7% reduction in pneumococcal disease episodes leading to a US\$1.97 million reduction in treatment costs and a 6.1% reduction in childhood mortality annually. In the base case analysis, costs per discounted DALY and per death averted by PCV10, amounted to US\$ 59 (95% CI 26–103) and US\$ 1,958 (95% CI 866–3,425), respectively. PCV13 introduction improved the cost-effectiveness ratios by approximately 20% and inclusion of indirect effects improved cost-effectiveness ratios by 43–56%. The break-even prices for introduction of PCV10 and PCV13 are US\$ 0.41 and 0.51, respectively.

CONCLUSIONS: Introducing either PCV10 or PCV13 in Kenya is highly cost-effective from a societal perspective. Indirect effects, if they occur, would significantly improve the cost-effectiveness.

148. Severe lower respiratory tract infection in early infancy and pneumonia hospitalizations among children, Kenya.

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Emerg Infect Dis. 2013 Feb;19(2):223-9. doi: 10.3201/eid1902.120940. PMID: 23347702; PMCID: PMC3559052.

ABSTRACT

Severe lower respiratory tract infection (LRTI) in infants caused by respiratory syncytial virus (RSV) has been associated with later pneumonia hospitalization among children. To determine risk for pneumonia after RSV hospitalization in infancy, we conducted a retrospective cohort analysis of 2,813 infants admitted to a hospital in Kenya and identified readmissions for pneumonia among this group during early childhood (<60 months of age). Incidence of readmission for pneumonia was higher for children whose first admission as infants was for LRTI and who were <3 months of age than for children who were first admitted as infants for non-LRTI, irrespective of RSV status. Incidence of readmission for pneumonia with wheeze was higher for children whose first admission involved RSV compared with those who had non-RSV LRTI. Excess pneumonia risk persisted for 2 years after the initial hospitalization. Close post-discharge

follow-up of infants with LRTI, with or without RSV, could help prevent severe pneumonia later in childhood.

149. Putting surveillance data into context: the role of health care utilization surveys in understanding population burden of pneumonia in developing countries.

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J Epidemiol Glob Health. 2012 Jun;2(2):73-81. doi: 10.1016/j.jegh.2012.03.001. Epub 2012 May 22. PMID: 23856423; PMCID: PMC7103994.

ABSTRACT

BACKGROUND: Surveillance is essential to estimating the global burden of pneumonia, yet differences in surveillance methodology and health care-seeking behaviors limit inter-country comparisons.

METHODS: Results were compared from community surveys measuring health care-seeking for pneumonia defined as: (1) cough and difficulty breathing for ≥ 2 days; or, (2) provider-diagnosed pneumonia. Surveys were conducted in six sites in Guatemala, Kenya and Thailand; these sites also conduct, active, hospital- and population-based disease surveillance for pneumonia.

RESULTS: Frequency of self-reported pneumonia during the preceding year ranged from 1.1% (Thailand) to 6.3% (Guatemala) and was highest in children aged <5 years and in urban sites. The proportion of persons with pneumonia who sought hospital-based medical services ranged from 12% (Guatemala, Kenya) to 80% (Thailand) and was highest in children <5 years of age. Hospitals and private provider offices were the most common places where persons with pneumonia sought health care. The most commonly cited reasons for not seeking health care were: (a) mild illness; (b) already recovering; and (3) cost of treatment.

CONCLUSIONS: Health care-seeking patterns varied widely across countries. Using results from standardized health care utilization surveys to adjust facility-based surveillance estimates of pneumonia allows for more accurate and comparable estimates.

150. Treatment failure among Kenyan children with severe pneumonia--a cohort study.

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Pediatr Infect Dis J. 2012 Sep;31(9): e152-7. doi: 10.1097/INF.0b013e3182638012. PMID: 22692700; PMCID: PMC3691501.

ABSTRACT

BACKGROUND: Pneumonia is the leading cause of childhood mortality worldwide. The WHO recommends presumptive treatment based on clinical syndromes. Recent studies raise concerns over the frequency of treatment failure in Africa.

METHODS: We applied a definition of treatment failure to data prospectively collected from children who were 2-59 months with severe, or very severe pneumonia admitted to Kilifi District Hospital, Kenya from May 2007 through May 2008 and treated using WHO guidelines. The primary outcome was treatment failure at 48 hours.

RESULTS: Of 568 children, median age 11 months, 165 (29%) had very severe pneumonia, 30 (5.3%) a positive HIV test and 62 (11%) severe malnutrition. 111 (20%, 95% CI 17-23%) children failed treatment at 48 hours and 34 (6.0%) died, 22 (65%) deaths occurred before 48 hours. Of 353 children with severe pneumonia, without HIV or severe malnutrition, 42 (12%) failed to respond at 48 hours, 15 (4.3%) failed at 5 days and one child (0.3%) died. Among 215 children with either severe pneumonia complicated by HIV or severe malnutrition, or very severe pneumonia, 69 (32%) failed to treatment at 48 hours, 47 (22%) failed at 5 days and 33 (16%) died. Treatment failure at 48 hours was associated with shock, bacteremia, very severe pneumonia, SaO₂<95%, severe malnutrition, HIV, and age <1 year in multivariable models.

CONCLUSIONS: In this setting, few children with uncomplicated severe pneumonia fail treatment or die under current guidelines. Deaths mainly occurred early and may be reduced by improving prevention, pre-hospital care and treatment of sepsis.

151. A preliminary study of pneumonia etiology among hospitalized children in Kenya .

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Clin Infect Dis. 2012 Apr;54 Suppl 2(Suppl 2):S190-9. doi: 10.1093/cid/cir1071. Erratum in: Clin Infect Dis. 2013 May;56(10):1518. PMID: 22403235; PMCID: PMC3297554.

ABSTRACT

Excellence of data quality Background. Pneumonia is the leading cause of childhood death in the developing world. Higher-quality etiological data are required to reduce this mortality burden.

METHODS. We conducted a case-control study of pneumonia etiology among children aged 1–59 months in rural Kenya. Case patients were hospitalized with World Health Organization–defined severe pneumonia (SP) or very severe pneumonia (VSP); controls were outpatient children without pneumonia. We collected blood for culture, induced sputum for culture and multiplex polymerase chain reaction (PCR), and obtained oropharyngeal swab specimens for multiplex PCR from case patients, and serum for serology and nasopharyngeal swab specimens for multiplex PCR from case patients and controls.

RESULTS. Of 984 eligible case patients, 810 (84%) were enrolled in the study; 232 (29%) had VSP. Blood cultures were positive in 52 of 749 case patients (7%). A predominant potential pathogen was identified in sputum culture in 70 of 417 case patients (17%). A respiratory virus was detected by PCR from nasopharyngeal swab specimens in 486 of 805 case patients (60%) and 172 of 369 controls (47%). Only respiratory syncytial virus (RSV) showed a statistically significant association between virus detection in the nasopharynx and pneumonia hospitalization (odds ratio, 12.5; 95% confidence interval, 3.1–51.5). Among 257 case patients in whom all specimens (excluding serum specimens) were collected, bacteria were identified in 24 (9%), viruses in 137 (53%), mixed viral and bacterial infection in 39 (15%), and no pathogen in 57 (22%); bacterial causes outnumbered viral causes when the results of the case-control analysis were considered.

CONCLUSIONS. A potential etiology was detected in >75% of children admitted with SP or VSP. Except for RSV, the case-control analysis did not detect an association between viral detection in the nasopharynx and hospitalization for pneumonia.

152. Pneumonia Methods Working Group. The definition of pneumonia, the assessment of severity, and clinical standardization in the Pneumonia Etiology Research for Child Health study.

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Clin Infect Dis. 2012 Apr;54 Suppl 2(Suppl 2): S109-16. doi: 10.1093/cid/cir1065. PMID: 22403224; PMCID: PMC3297550.

ABSTRACT

To develop a case definition for the Pneumonia Etiology Research for Child Health (PERCH) project, we sought a widely acceptable classification that was linked to existing pneumonia research and focused on very severe cases. We began with the World Health Organization's classification of severe/very severe pneumonia and refined it through literature reviews and a 2-stage process of expert consultation. PERCH will study hospitalized children, aged 1–59 months, with pneumonia who present with cough or difficulty breathing and have either severe pneumonia (lower chest wall in drawing) or very severe pneumonia (central cyanosis, difficulty breastfeeding/drinking, vomiting everything, convulsions, lethargy, unconsciousness, or head nodding). It will exclude patients with recent hospitalization and children with wheeze whose indrawing resolves after bronchodilator therapy. The PERCH investigators agreed upon standard interpretations of the symptoms and signs. These will be maintained by a clinical standardization monitor who conducts repeated instruction at each site and by recurrent local training and testing.

153. EFFICACY OF *Cassia senna* PLANT EXTRACTS AGAINST *Klebsiella pneumoniae*, *Enterobacter aerogenes*, *Staphylococcus aureus* and *Escherichia coli*

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Proceedings of the 3rd KEMRI Annual Health & Scientific (KASH) Conference, 2013

ABSTRACT

BACKGROUND: *Cassia senna* plant having a history of use as a traditional medicine in some communities like the kalenjins of Kenya was investigated for its antimicrobial activity *in vitro*. **Objective:** The purpose of this study was to assess whether the plant solvent extracts presented inhibition properties against this microorganism.

METHODS: Acetone and methanol crude extracts of *Cassia senna* were derived. *In vitro* Antibacterial screening of the extracts was performed by culture and sensitivity against

standard cultures of *Klebsiella pneumoniae* ATCC 700721, *Enterobacter aerogenes* ATCC 13048, *Staphylococcus aureus* ATCC 25923 and *Escherichia coli* ATCC 25922. Bacterial isolates were aseptically streaked on Mueller Hinton agar medium and incubated at 37°C for 24 hours. A concentration of 0.1 g/cm³ of the crude extracts was designed and impregnated on paper discs. The dry paper discs were placed on the surface seeded with microorganisms, incubated at 4°C overnight then transferred to 37°C for 24 hours. Penicillin (10 µg) was used as a positive control. The activity of the test extracts was established by measuring zone of inhibition in mm. MIC was also determined on extracts that showed activity on microorganisms.

RESULTS: Generally, methanol extracts showed weak antibacterial activity against the study organisms compared to ethanol extract. And also, the inhibition zone for the *Cassia senna* crude extracts was smaller as compared to the Penicillin. All extracts exhibited a significant bactericidal activity against *K. pneumoniae* while *Cassia senna* exhibited limited efficacy against *E. coli*. MIC of acetone crude extracts in most microorganisms was 0.00001 g/cm³ while methanol's extract was 0.001 g/cm³.

CONCLUSION: The presence of inhibition zones proved that *Cassia senna* has antimicrobial activity against the tested microorganisms.

154. Laboratory Surveillance of Influenza Viruses from Sentinel Sites in Nairobi, Kenya 2001-2010

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ABSTRACT

BACKGROUND: Influenza viruses are important causes of local and worldwide epidemics where severe cases could account for up to 3-5 million and quarter to half a million deaths annually. They cause a broad range of illnesses including symptomless infections, sudden severe viral infections that lead to pneumonia. Countries in the developed world and South Africa had influenza surveillance programmes but this was lacking in Kenya. Therefore an influenza surveillance network was set up involving private clinics within Nairobi.

OBJECTIVE: To determine the prevalence of influenza types circulating, ages and gender of patients affected, plus also the seasonality.

METHODS: Patients recruited in the study had to be having signs of influenza like illness. Consent was obtained from parents/guardians especially for children, while for adults consent was obtained directly from them. There were 12 sentinel sites (private clinics) around Nairobi. A throat swab was collected from these patients and sent to the National Influenza Center, Center for Virus Research, KEMRI for processing and virus detections.

RESULTS: There were 3639 patients recruited for the study. Influenza was detected in 579 (15.9%) patients, with influenza B (n = 447; 12.7%) being more predominant than influenza A (n = 132; 3.6%). Majority of influenza viruses were detected in patients in the 2months – 10 year age range category (n = 177; 19.8%) followed by the 21 -30years category (n = 160; 17.2%). Males (n = 294; 16.3%) had slightly more influenza viruses detected in them than female (n = 280; 15.7%) patients. Majority of the influenza detections were occurring in the months of March to August of the study period, with highest peaks seen between March and July of each year.

CONCLUSIONS: Influenza viruses circulate all year round in Nairobi, Kenya with most detections occurring in the months of March to August of each year. They mainly affect children aged 2months – 10 years with males being slightly more affected than females.

155. Medicinal Properties of *Fuerstia africana* T.C.E. Friers (Lamiaceae)

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Proceedings of the 3rd KEMRI Annual Health & Scientific (KASH) Conference, 2013

ABSTRACT

BACKGROUND: *Fuerstia africana* is endemic in tropical East Africa. The leaves are used to treat malaria and mouth infections among other ailments. Due to the high morbidity and mortality associated with these conditions, and the high cost of conventional therapies, there is need to search for cheaper but safe and effective alternatives from plants.

OBJECTIVE: The objective of this study was to establish the anti-malarial and anti-microbial activities and the cytotoxicity effects of *Fuerstia africana* extracts.

METHODOLOGY: Extracts from *Fuerstia africana* were prepared using organic solvents (petroleum ether, ethyl acetate and methanol) and tested for cytotoxicity on Vero cells. They were screened against *Plasmodium falciparum* (D6, chloroquine sensitive and W2, chloroquine resistant strains) and against *P. berghei* (strain ANKA) in mice. They were also screened for antimicrobial activities against five strains of bacteria and one strain of fungi using the diffusion method.

RESULTS: The petroleum ether extracts of the aerial parts and roots of *Fuerstia africana* demonstrated the promising anti-plasmodial activity against the chloroquine sensitive plasmodial strain D6 (IC₅₀ 1.5 & 4.6 µg/ml, respectively) and exhibited moderate cytotoxicity against Vero cells. The methanol extract of the root exhibited moderate anti-malarial activity in the in vivo bioassay. In the anti-microbial assays, all the extracts

showed activity against the tested microbial strains and the methanolic extracts of the aerial parts had the best activity against *Klebsiella pneumoniae*, a gram-negative bacterial strain. Generally, methanolic extracts of the aerial parts showed the best activity against all the tested microbial strains with activity index values of 0.5 and above.

CONCLUSION: This study authenticates the traditional medicinal uses of *Fuerstia africana* by indigenous people for treatment of malaria, bacterial and fungal infections. Further studies to identify the bioactive molecules which can be used as markers for quality control are ongoing.

156. Comparison of PCR and phenotypic detection methods for Methicillin resistant *Staphylococcus aureus*

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Proceedings of the 2nd KEMRI Annual Health & Scientific (KASH) Conference, 2012

ABSTRACT

INTRODUCTION: *Staphylococcus aureus* is one of the most significant human pathogens causing both nosocomial and community acquired infections. *Staphylococcus aureus* can cause a range of infections from mild to life threatening conditions such as pneumonia. Strains of MRSA have spread between different hospitals, cities, countries, and even continents and are now the cause of hospital infections. Resistance to methicillin and other beta lactam antibiotics is mediated by the over production of an additional altered novel penicillin binding protein (PBP) (PBP2a or PBP2`)

OBJECTIVES: The broad objective was to compare between phenotypic detection methods for MRSA and polymerase chain reaction (PCR) assay in clinical isolates. **Methods:** A total of 100 *Staphylococcal* clinical isolates were initially identified and confirmed by API and then subjected to E-Test MIC (oxacillin and cefotaxime), MRSA Latex agglutination test and PCR assay for *Mec A gene* as the “gold standard” for MRSA detection.

RESULTS: Out of the 100 isolates, 31% were (MRSA) resistant to both oxacillin and cefotaxime, while MRSA detection by latex agglutination and PCR was 37% and 40% respectively. All the isolates from lung aspirates showed very high resistance of >256 for both oxacillin and cefotaxime while wound swabs recorded the highest percentage of MRSA with HVS and CSF recording none.

RECOMMENDATIONS /CONCLUSIONS: There is need to put in place strategies to strengthen and sustain public health laboratories to be able to diagnose and identify MRSA correctly. Infection-control program should be prioritized in all public health facilities. Early and specific

diagnosis of MRSA infections is important in preventing their spread. MRSA prevalence is best predicted by use of PCR in epidemiological studies but phenotypic methods are suitable when it comes to immediate treatment and management of *Staphylococcal* infections.

157. Pneumococcal Protein Vaccines: Using DNA Microarrays to Identify Novel Protein Antigens

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Proceedings of the 2nd KEMRI Annual Health & Scientific (KASH) Conference, 2012

ABSTRACT

Streptococcus pneumoniae (the pneumococcus) continues to be a leading cause of morbidity and mortality worldwide in both children and adults, despite the availability of pneumococcal vaccines. This can be explained partly by the fact that the available vaccines either do not elicit long-lasting protection or are limited in strain coverage. A protein antigen immunogenic in infants and with a conserved epitope across all serotypes would overcome some of the limitations of the current vaccines. The aim of this work was to find novel proteins that might be used as future vaccine antigens. A vaccine that prevents adherence/colonization would naturally prevent the development of subsequent more serious infections.

We used a combination of adherence assays, transcriptomics (oligonucleotide-based DNA microarrays) and functional genomics (insertion-deletion mutagenesis) to identify genes involved in adherence. Two pneumococcal strains were used in the study. The adherence assays showed that both pneumococcal strains used in the study adhered and invaded the nasopharyngeal cells, though with varying capacities. Upon interaction with nasopharyngeal cells, both strains altered their gene expression profiles relative to control bacteria. In total, 213 genes were up-regulated by adherent pneumococci and 183 were down-regulated. A high proportion of genes of unknown function were up-regulated suggesting the need for further characterization. The function of a few over-expressed genes was further analyzed using insertion-deletion mutagenesis. The ability of mutants to adhere to human nasopharyngeal cells was compared against the wild-type strains. Five mutants representing novel genes were, to different degrees, attenuated in adherence. This study provides insights into the shared and distinct mechanisms involved in mediating adherence of two pneumococcal strains to epithelial cells. We have identified genes that play an important role in adhesion, and therefore potential targets for vaccines against pneumococcal colonization.

158. Nasopharyngeal carriage of potential respiratory pathogens within Kilifi district in Kenya

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ABSTRACT

BACKGROUND: Nasopharyngeal (NP) carriage of potential respiratory pathogens (eg, *S. aureus*, *S. pneumoniae*, or *H. influenzae*), usually precedes invasive disease. Introduction of 10-valent pneumococcal conjugate vaccine (PCV10) into the Kenya EPI programme is expected to reduce carriage of vaccine-serotype pneumococci and to reduce invasive pneumococcal disease. Changes in pneumococcal carriage may affect carriage of other bacteria.

OBJECTIVE: We aimed to describe the patterns of nasopharyngeal colonization in residents of the Kilifi Demographic Surveillance System (DSS).

METHODS: A community based cross-sectional study of NP carriage among residents of all ages randomly selected from the Kilifi DSS was performed during August-October 2010. Following consent, a questionnaire was administered and a NP swab was collected. Swabs were transported in cool boxes to the KEMRI/Wellcome Trust microbiology laboratory. Bacteria were identified by standard methods. Pneumococcal serotyping was performed by the Quellung reaction. Data were analysed using STATA 11.1. Multivariate logistic regression was used to assess factors associated with carriage.

RESULTS: Among the 512 participants, 53.9% were females; 39.5% carried *S. pneumoniae*, 32.6% carried *H. influenzae*, and 6.6% carried *S. aureus*. Among participants aged <5 years (n=157), 70.1% carried *S. pneumoniae*. Vaccine serotypes represented 45.5% of pneumococcal carriage in children aged <5 years. Risk factors for *S. pneumoniae* were age<1 year (OR 3.57; 95% confidence interval [CI]:1.72-7.41), respiratory infection (OR 2.20; 95%CI:1.38-3.49) the presence of children in the household (OR 3.01; 95%CI:1.67-5.43) and co-carriage of *H. influenzae* (OR 4.56; 95%CI:3.00-6.95). Expanded testing of a subset of swabs from children aged <10 years (n=111) revealed carriage of coliforms in 52.3%, *M. catarrhalis* in 73.9%, and no carriage of *Neisseria* species, *Salmonella* species or group D *Streptococcus*.

CONCLUSIONS: Vaccine serotypes represent a sizable proportion of pneumococcal carriage. These data will serve as a baseline for evaluating the effect of PCV10 on carriage of pneumococcus and other potential respiratory pathogens

159. Bacterial causes of pneumonia in children under 5 years of age in Nairobi, Kenya.

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Proceedings of the 1st KEMRI Annual Health & Scientific (KASH) Conference, 2011

ABSTRACT

BACKGROUND: Pneumonia kills more children than any other illness and is a significant problem worldwide. Objective: To determine spectrum and antibiogram of bacterial causes of mild and severe pneumonia in children under five years. Design: Cross sectional laboratory based. Setting: Kenyatta National hospital (KNH) and Mbagathi District hospital (MDH) in Nairobi, Kenya. Subjects: Children under 5 years presenting with clinical pneumonia between 2002 to 2005.

METHODS: Bacterial culture of nasopharyngeal aspirate (NPA) and 5 ml venous blood was done on blood agar, chocolate agar, bromothymol blue and brain heart infusion broth. Identification performed using analytical profile index (API) and drug susceptibility using agar dilution as recommended by clinical and laboratory standards institute (CLSI).

Results: A total of 639 respondents were investigated for bacterial causes of mild (459) and severe (180) pneumonia. The bacterial spectrum in mild and severe pneumonia was different with the first two being *S. pneumonia* 98/210 (46.67%) and *H. influenza* 20/210 (9.52%) in mild and *K. pneumonia* 10.0% and *S. aureus* 7.62% in severe pneumonia. Penicillin resistant *S. pneumonia* was 4.6% with 37.9% intermediate resistance. Trimethoprim/sulfamethoxazole (TMP-SMX) and gentamicin was 83.8% and 34.8% respectively. There was high level resistance exhibited by *K. pneumonia* and *S. aureus* to the commonly used antibiotics for treatment of pneumonia.

CONCLUSION: The spectrum of bacterial causes of mild and severe pneumonia is different with *S. pneumonia* and *K. pneumonia* being the major causes respectively. Penicillin is still the drug of choice for treatment of pneumococcal pneumonia. More drug resistance surveillance studies are encouraged.

160. Pneumococcal Conjugate Vaccine at birth provokes effective IgG titres and primes immunological memory

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Proceedings of the 1st KEMRI Annual Health & Scientific (KASH) Conference, 2011

ABSTRACT

BACKGROUND: In Kenya, 15% of invasive pneumococcal disease (IPD) targeted by new Pneumococcal Conjugate Vaccines (PCV) occurs before young infants are routinely immunised. Newborn immunisation could protect young infants but there are theoretical concerns it could lead to immune tolerance.

METHODS. In a randomized schedule trial children received either 7-valent PCV at 6-10-14 weeks (EPI group) or 0-10-14 weeks (Newborn group). Safety was monitored actively, at 2 or 7 days, and passively thereafter. Serum was obtained at birth, 6, 10, 14, 18, 36 and 37 weeks and

assayed by ELISA for concentration and avidity of anti-capsular IgG. Infants were boosted with either 7vPCV or one-fifth dose of pneumococcal polysaccharide vaccine at 36 weeks. Nasopharyngeal swabs were taken at 18 and 36 weeks.

RESULTS. Three-hundred children were randomised equally into the vaccine groups. Newborn vaccination was well tolerated and safe; adverse events occurred in equal frequency in each group and none was related to immunisation. One child, immunised at birth, died of unrelated neonatal sepsis. At 18 weeks $\geq 87\%$ of infants had protective concentrations ($\geq 0.35 \mu\text{g/ml}$) for all serotypes with no significant differences between groups. Geometric mean concentrations were higher in the EPI group for serotypes 4, 9V, 18C and 19F at 18 weeks and serotype 4 at 36 weeks. Avidity was greater in the Newborn group for serotypes 4, 6B and 19F at 18 weeks and serotype 19F at 36 weeks. Booster responses and the prevalence of vaccine-serotype and non-vaccine-type carriage did not differ between groups.

CONCLUSIONS. PCV was safe, immunogenic and primed for memory when given shortly after birth. There was no evidence of immune tolerance. Where IPD occurs early, vaccination coverage is delayed or indirect protection fails, newborn vaccination offers an alternative to control IPD in vulnerable young infants.

161. Carriage Rate and Serotypes of *Streptococcus pneumoniae* in children at Thika District Hospital Kenya

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ABSTRACT

BACKGROUND: *Streptococcus pneumoniae* is a major cause of morbidity and mortality worldwide causing diseases that range in severity from meningitis, septicemia, and pneumonia to sinusitis and acute otitis media. Rates of carriage are highest in infants and the elderly.

OBJECTIVE: To determine the rate of nasopharyngeal colonization by *S. pneumoniae*, distribution of serotypes and antimicrobial susceptibility in children below five years, admitted in Thika District Hospital.

METHODOLOGY: Cross sectional study design was used. Nasopharyngeal swabs were collected from 315 children in the month of September and October 2010 and processed to isolate *S. pneumoniae*. The isolates were serotyped by the Quellung reaction and their antibiotic susceptibilities assessed by disk diffusion method.

RESULTS: The overall nasopharyngeal carriage rate for *S. pneumoniae* was 18%. The highest rate of carriage was found in children between one and two years (23%). There was no significant difference in carriage rates between males and females. Seventeen serotypes were detected

among 55 strains analyzed. The isolates belonged to serotypes 6A, 23F, 19F, 13, 6B, 14A, 20, 7C, 1, 15B, 35B, 19A, 11A, 34, 5, 3 and 23A. The three most frequent serotypes were serotype 6A, 23F and 19F. Susceptibility testing revealed that 7% of the isolates were resistant to penicillin and cefotaxime. Resistance to chloramphenicol and erythromycin was 2% and 4%, respectively. High levels of resistance were noted for cotrimoxazole (98%). All isolates were fully sensitive to tetracycline.

CONCLUSION: There was high level of cotrimoxazole resistance and to other antimicrobial agents commonly used in Kenya. There will be need to revise antimicrobial policy in the treatment of invasive pneumococcal infections. The most frequently isolated serotypes are included in the seven-valent vaccine and immunization therefore will be important as a prevention tool for pneumococcal infections in the region.

31 citations
(Sorted by Partner State)

Rwanda



1. Epidemiological and spatio-temporal characteristics of COVID-19 in Rwanda

Benimana TD¹, Lee N¹, Jung S¹, Lee W¹, Hwang SS¹.

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ABSTRACT

BACKGROUND: The coronavirus disease 2019 (COVID-19) has taken millions of lives and disrupted living standards at individual, societal, and worldwide levels, causing serious consequences globally. Understanding its epidemic curve and spatio-temporal dynamics is crucial for the development of effective public health plans and responses and the allocation of resources. Thus, we conducted this study to assess the epidemiological dynamics and spatio-temporal patterns of the COVID-19 pandemic in Rwanda.

METHODS: Using the surveillance package in R software version 4.0.2, we implemented endemic-epidemic multivariate time series models for infectious diseases to analyze COVID-19 data reported by Rwanda Biomedical Center under the Ministry of Health from March 15, 2020 to January 15, 2021.

RESULTS: The COVID-19 pandemic occurred in two waves in Rwanda and showed a heterogenous spatial distribution across districts. The Rwandan government responded effectively and efficiently through the implementation of various health measures and intervention policies to drastically reduce the transmission of the disease. Analysis of the three components of the model showed that the most affected districts displayed epidemic components within the area, whereas the effect of epidemic components from spatial neighbors were experienced by the districts that surround the most affected districts. The infection followed the disease endemic trend in other districts.

CONCLUSION: The epidemiological and spatio-temporal dynamics of COVID-19 in Rwanda show that the implementation of measures and interventions contributed significantly to the decrease in COVID-19 transmission within and between districts. This accentuates the critical call for continued intra- and inter- organization and community engagement nationwide to ensure effective and efficient response to the pandemic.

2. Genomic sequencing of SARS-CoV-2 in Rwanda reveals the importance of incoming travelers on lineage diversity

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ABSTRACT

COVID-19 transmission rates are often linked to locally circulating strains of SARS-CoV-2. Here we describe 203 SARS-CoV-2 whole genome sequences analyzed from strains circulating in Rwanda from May 2020 to February 2021. In particular, we report a shift in variant distribution towards the emerging sub-lineage A.23.1 that is currently dominating. Furthermore, we report the

detection of the first Rwandan cases of the B.1.1.7 and B.1.351 variants of concern among incoming travelers tested at Kigali International Airport. To assess the importance of viral introductions from neighboring countries and local transmission, we exploit available individual travel history metadata to inform spatio-temporal phylogeographic inference, enabling us to take into account infections from unsampled locations. We uncover an important role of neighboring countries in seeding introductions into Rwanda, including those from which no genomic sequences were available. Our results highlight the importance of systematic genomic surveillance and regional collaborations for a durable response towards combating COVID-19.

3. The toll of COVID-19 on African children: A descriptive analysis on COVID-19-related morbidity and mortality among the pediatric population in Sub-Saharan Africa

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ABSTRACT

INTRODUCTION: Few data on the COVID-19 epidemiological characteristics among the pediatric population in Africa exists. This paper examines the age and sex distribution of the morbidity and mortality rate in children with COVID-19 and compares it to the adult population in 15 Sub-Saharan African countries.

METHODS: A merge line listing dataset shared by countries within the Regional Office for Africa was analyzed. Patients diagnosed within 1 March and 1 September 2020 with a confirmed positive RT-PCR test for SARS-CoV-2 were analyzed. Children's data were stratified into three age groups: 0-4 years, 5-11 years, and 12-17 years, while adults were combined. The cumulative incidence of cases, its medians, and 95% confidence intervals were calculated.

RESULTS: 9% of the total confirmed cases and 2.4% of the reported deaths were pediatric cases. The 12-17 age group in all 15 countries showed the highest cumulative incidence proportion in children. Adults had a higher case incidence per 100,000 people than children.

CONCLUSION: The cases and deaths within the children's population were smaller than the adult population. These differences may reflect biases in COVID-19 testing protocols and reporting implemented by countries, highlighting the need for more extensive investigation and focus on the effects of COVID-19 in children.

4. The East African Community (EAC) mobile laboratory networks in Kenya, Burundi, Tanzania, Rwanda, Uganda, and South Sudan-from project implementation to outbreak response against Dengue, Ebola, COVID-19, and epidemic-prone diseases

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ABSTRACT

BACKGROUND: East Africa is home to 170 million people and prone to frequent outbreaks of viral haemorrhagic fevers and various bacterial diseases. A major challenge is that epidemics mostly happen in remote areas, where infrastructure for Biosecurity Level (BSL) 3/4 laboratory capacity is not available. As samples have to be transported from the outbreak area to the National Public Health Laboratories (NPHL) in the capitals or even flown to international reference centres, diagnosis is significantly delayed and epidemics emerge.

MAIN TEXT: The East African Community (EAC), an intergovernmental body of Burundi, Rwanda, Tanzania, Kenya, Uganda, and South Sudan, received 10 million € funding from the German Development Bank (KfW) to establish BSL3/4 capacity in the region. Between 2017 and 2020, the EAC in collaboration with the Bernhard-Nocht-Institute for Tropical Medicine (Germany) and the Partner Countries' Ministries of Health and their respective NPHLs, established a regional network of nine mobile BSL3/4 laboratories. These rapidly deployable laboratories allowed the region to reduce sample turn-around-time (from days to an average of 8h) at the centre of the outbreak and rapidly respond to epidemics. In the present article, the approach for implementing such a regional project is outlined and five major aspects (including recommendations) are described: (i) the overall project coordination activities through the EAC Secretariat and the Partner States, (ii) procurement of equipment, (iii) the established laboratory setup and diagnostic panels, (iv) regional training activities and capacity building of various stakeholders and (v) completed and ongoing field missions. The latter includes an EAC/WHO field simulation exercise that was conducted on the border between Tanzania and Kenya in June 2019, the support in molecular diagnosis during the Tanzanian Dengue outbreak in 2019, the participation in the

Ugandan National Ebola response activities in Kisoro district along the Uganda/DRC border in Oct/Nov 2019 and the deployments of the laboratories to assist in SARS-CoV-2 diagnostics throughout the region since early 2020.

CONCLUSIONS: The established EAC mobile laboratory network allows accurate and timely diagnosis of BSL3/4 pathogens in all East African countries, important for individual patient management and to effectively contain the spread of epidemic-prone diseases.

5. Investigation of Four Clusters of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) in Rwanda, 2020

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ABSTRACT

We reported the findings of the first Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) four clusters identified in Rwanda. Case-investigations included contact elicitation, testing, and isolation/quarantine of confirmed cases. Socio-demographic and clinical data on cases and contacts were collected. A confirmed case was a person with laboratory confirmation of SARS-CoV-2 infection (PCR) while a contact was any person who had contact with a SARS-CoV-2 confirmed case within 72 h prior, to 14 days after symptom onset; or 14 days before collection of the laboratory-positive sample for asymptomatic cases. High risk contacts were those who had come into unprotected face-to-face contact or had been in a closed environment with a SARS-CoV-2 case for >15 min. Forty cases were reported from four clusters by 22 April 2020, accounting for 61% of locally transmitted cases within six weeks. Clusters A, B, C and D were associated with two nightclubs, one house party, and different families or households living in the same compound (multi-family dwelling). Thirty-six of the 1035 contacts tested were positive (secondary attack rate: 3.5%). Positivity rates were highest among the high-risk contacts compared to low-risk contacts (10% vs. 2.2%). Index cases in three of the clusters were imported through international travelling. Fifteen of the 40 cases (38%) were asymptomatic while 13/25 (52%) and

8/25 (32%) of symptomatic cases had a cough and fever respectively. Gatherings in closed spaces were the main early drivers of transmission. Systematic case-investigations contact tracing and testing likely contributed to the early containment of SARS-CoV-2 in Rwanda.

6. The secondary transmission pattern of COVID-19 based on contact tracing in Rwanda

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ABSTRACT

INTRODUCTION: COVID-19 has shown an exceptionally high spread rate across and within countries worldwide. Understanding the dynamics of such an infectious disease transmission is critical for devising strategies to control its spread. In particular, Rwanda was one of the African countries that started COVID-19 preparedness early in January 2020, and a total lockdown was imposed when the country had only 18 COVID-19 confirmed cases known. Using intensive contact tracing, several infections were identified, with the majority of them being returning travellers and their close contacts. We used the contact tracing data in Rwanda for understanding the geographic patterns of COVID-19 to inform targeted interventions.

METHODS: We estimated the attack rates and identified risk factors associated to COVID-19 spread. We used Bayesian disease mapping models to assess the spatial pattern of COVID-19 and to identify areas characterised by unusually high or low relative risk. In addition, we used multiple variable conditional logistic regression to assess the impact of the risk factors.

RESULTS: The results showed that COVID-19 cases in Rwanda are localized mainly in the central regions and in the southwest of Rwanda and that some clusters occurred in the northeast of Rwanda. Relationship to the index case, being male and coworkers are the important risk factors for COVID-19 transmission in Rwanda.

CONCLUSION: The analysis of contact tracing data using spatial modelling allowed us to identify high-risk areas at subnational level in Rwanda. Estimating risk factors for infection with SARS-

CoV-2 is vital in identifying the clusters in low spread of SARS-CoV-2 subnational level. It is imperative to understand the interactions between the index case and contacts to identify super spreaders, risk factors and high-risk places. The findings recommend that self-isolation at home in Rwanda should be reviewed to limit secondary cases from the same households and spatiotemporal analysis should be introduced in routine monitoring of COVID-19 in Rwanda for policy making decision on real time.

7. Rwanda COVID-19 Vaccination Program Implementation

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ABSTRACT

With more than 118.3 million cases and more than 2.6 million deaths from coronavirus disease 2019 (COVID-19) worldwide and more than 20,000 total cases and 275 deaths in Rwanda, efforts have been made to ensure global and non-discriminatory access to the vaccine. COVID-19 vaccines help develop immunity to the virus that causes COVID-19 by making the human body produce memory T-lymphocytes and B-lymphocytes that will remember how to fight that virus when attacked and effectively eliminate the viruses. As vaccination campaigns are underway in different countries, as of 9 March 2021, 300 million vaccine doses have been administered. Rwanda was not left behind in the fight against the pandemic and is among the first African countries to have started the COVID-19 vaccination campaign.

8. Lessons Learned from Rwanda: Innovative Strategies for Prevention and Containment of COVID-19

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ABSTRACT

INTRODUCTION: Rwanda has made significant advancements in medical and economic development over the last 20 years and has emerged as a leader in healthcare in the East African region. The COVID-19 pandemic, which reached Rwanda in March 2020, presented new and unique challenges for infectious disease control. The objective of this paper is to characterize Rwanda's domestic response to the first year of the COVID-19 pandemic and highlight effective strategies so that other countries, including high and middle-income countries, can learn from its innovative initiatives.

METHODS: Government publications describing Rwanda's healthcare capacity were first consulted to obtain the country's baseline context. Next, official government and healthcare system communications, including case counts, prevention and screening protocols, treatment facility practices, and behavioral guidelines for the public, were read thoroughly to understand the course of the pandemic in Rwanda and the specific measures in the response.

RESULTS: As of 31 December 2020, Rwanda has recorded 8,383 cumulative COVID-19 cases, 6,542 recoveries, and 92 deaths since the first case on 14 March 2020. The Ministry of Health, Rwanda Biomedical Centre, and the Epidemic and Surveillance Response division have collaborated on preparative measures since the pandemic began in January 2020. The formation of a Joint Task Force in early March led to the Coronavirus National Preparedness and Response Plan, an extensive six-month plan that established a national incident management system and detailed four phases of a comprehensive national response. Notable strategies have included disseminating public information through drones, robots for screening and inpatient care, and official communications through social media platforms to combat misinformation and mobilize a cohesive response from the population.

CONCLUSION: Rwanda's government and healthcare system has responded to the COVID-19 pandemic with innovative interventions to prevent and contain the virus. Importantly, the response has utilized adaptive and innovative technology and robust risk communication and community engagement to deliver an effective response to the COVID-19 pandemic.

9. One hundred thirty-three Observed COVID-19 deaths in 10 months: unpacking lower than predicted mortality in Rwanda

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ABSTRACT

The African region was predicted to have worse COVID-19 infection and death rates due to challenging health systems and social determinants of health. However, in the 10 months after its first case, Rwanda recorded 10316 cases and 133 COVID-19-related deaths translating to a case fatality rate (CFR) of 1.3%, which raised the question: why does Rwanda have a low COVID-19 CFR? Here we analysed COVID-19 data and explored possible explanations to better understand the disease burden in the context of Rwanda's infection control strategies. We investigated whether the age distribution plays a role in the observed low CFR in Rwanda by comparing the expected number of deaths for 10-year age bands based on the CFR reported in other countries with the observed number of deaths for each age group. We found that the age-specific CFRs in Rwanda are similar to or, in some older age groups, slightly higher than those in other countries, suggesting that the lower population level CFR reflects the younger age structure in Rwanda, rather than a lower risk of death conditional on age. We also accounted for Rwanda's comprehensive SARS-CoV-2 testing strategies and reliable documentation of COVID-19-related deaths and deduced that these measures may have allowed them to likely identify more asymptomatic or mild cases than other countries and reduced their reported CFR. Overall, the observed low COVID-19 deaths in Rwanda is likely influenced by the combination of effective infection control strategies, reliable identification of cases and reporting of deaths, and the population's young age structure.

10. Contact Tracing and the COVID-19 Response in Africa: Best Practices, Key Challenges, and Lessons Learned from Nigeria, Rwanda, South Africa, and Uganda

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ABSTRACT

Most African countries have recorded relatively lower COVID-19 burdens than Western countries. This has been attributed to early and strong political commitment and robust implementation of public health measures, such as nationwide lockdowns, travel restrictions, face mask wearing, testing, contact tracing, and isolation, along with community education and engagement. Other factors include the younger population age strata and hypothesized but yet-to-be confirmed partially protective cross-immunity from parasitic diseases and/or other circulating coronaviruses. However, the true burden may also be underestimated due to operational and resource issues for COVID-19 case identification and reporting. In this perspective article, we discuss selected best practices and challenges with COVID-19 contact tracing in Nigeria, Rwanda, South Africa, and Uganda. Best practices from these country case studies include sustained, multi-platform public communications; leveraging of technology innovations; applied public health expertise; deployment of community health workers; and robust community engagement. Challenges include an overwhelming workload of contact tracing and case detection for healthcare workers, misinformation and stigma, and poorly sustained adherence to isolation and quarantine. Important lessons learned include the need for decentralization of contact tracing to the lowest geographic levels of surveillance, rigorous use of data and technology to improve decision-making, and sustainment of both community sensitization and political commitment. Further research is needed to understand the role and importance of contact tracing in controlling community

transmission dynamics in African countries, including among children. Also, implementation science will be critically needed to evaluate innovative, accessible, and cost-effective digital solutions to accommodate the contact tracing workload.

11. From Easing Lockdowns to Scaling Up Community-based Coronavirus Disease 2019 Screening, Testing, and Contact Tracing in Africa-Shared Approaches, Innovations, and Challenges to Minimize Morbidity and Mortality

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ABSTRACT

The arrival of coronavirus disease 2019 (COVID-19) on the African continent resulted in a range of lockdown measures that curtailed the spread of the infection but caused economic hardship. African countries now face difficult choices regarding easing of lockdowns and sustaining effective public health control measures and surveillance. Pandemic control will require efficient community screening, testing, and contact tracing; behavioral change interventions; adequate resources; and well-supported, community-based teams of trained, protected personnel. We discuss COVID-19 control approaches in selected African countries and the need for shared, affordable, innovative methods to overcome challenges and minimize mortality. This crisis presents a unique opportunity to align COVID-19 services with those already in place for human immunodeficiency virus, tuberculosis, malaria, and non-communicable diseases through mobilization of Africa's interprofessional healthcare workforce. By addressing the challenges, the detrimental effect of the COVID-19 pandemic on African citizens can be minimized.

12. A pooled testing strategy for identifying SARS-CoV-2 at low prevalence

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ABSTRACT

Suppressing infections of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) will probably require the rapid identification and isolation of individuals infected with the virus on an ongoing basis. Reverse-transcription polymerase chain reaction (RT-PCR) tests are accurate but costly, which makes the regular testing of every individual expensive. These costs are a challenge for all countries around the world, but particularly for low-to-middle-income countries. Cost reductions can be achieved by pooling (or combining) subsamples and testing them in groups 1-7. A balance must be struck between increasing the group size and retaining test sensitivity, as sample dilution increases the likelihood of false-negative test results for individuals with a low viral load in the sampled region at the time of the test. Similarly, minimizing the number of tests to reduce costs must be balanced against minimizing the time that testing takes, to reduce the spread of the infection. Here we propose an algorithm for pooling subsamples based on the geometry of a hypercube that, at low prevalence, accurately identifies individuals infected with SARS-CoV-2 in a small number of tests and few rounds of testing. We discuss the optimal group size and explain why, given the highly infectious nature of the disease, largely parallel searches are preferred. We report proof-of-concept experiments in which a positive subsample was detected even when diluted 100-fold with negative subsamples (compared with 30-48-fold dilutions described in previous studies 9-11). We quantify the loss of sensitivity due to dilution and discuss how it may be mitigated by the frequent re-testing of groups, for example. With the use of these methods, the cost of mass testing could be reduced by a large factor. At low prevalence, the costs decrease in rough proportion to the prevalence. Field trials of our approach are under way in Rwanda and South Africa. The use of group testing on a massive scale to monitor infection rates closely and continually in a population, along with the rapid and effective isolation of people with SARS-CoV-2 infections, provides a promising pathway towards the long-term control of coronavirus disease 2019 (COVID-19).

13. Human Respiratory Syncytial Virus Detected in Mountain Gorilla Respiratory Outbreaks

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ABSTRACT

Respiratory illness (RI) accounts for a large proportion of mortalities in mountain gorillas (*Gorilla beringei beringei*), and fatal outbreaks, including disease caused by human metapneumovirus (HMPV) infections, have heightened concern about the risk of human pathogen transmission to this endangered species, which is not only critically important to the biodiversity of its ecosystem but also to the economies of the surrounding human communities. Our goal was to conduct a molecular epidemiologic study to detect the presence of HRSV and HMPV in fecal samples from wild human-habituated free-ranging mountain gorillas in Rwanda and to evaluate the role of these viruses in RI outbreaks. Fecal samples were collected from gorillas with clinical signs of RI between June 2012 and February 2013 and tested by real-time and conventional polymerase chain reaction (PCR) assays; comparison fecal samples were obtained from gorillas without clinical signs of RI sampled during the 2010 Virunga gorilla population census. PCR assays detected HMPV and HRSV first in spiked samples; subsequently, HRSV-A, the worldwide-circulating ON1 genotype, was detected in 12 of 20 mountain gorilla fecal samples collected from gorillas with RI during outbreaks, but not in samples from animals without respiratory illness. Our findings confirmed that pathogenic human respiratory viruses are transmitted to gorillas and that they are repeatedly introduced into mountain gorilla populations from people, attesting to the need for stringent biosecurity measures for the protection of gorilla health.

14. Sub-Saharan Africa preparedness and response to the COVID-19 pandemic: A perspective of early career African scientists

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ABSTRACT

Emerging highly transmissible viral infections such as SARS-CoV-2 pose a significant global threat to human health and the economy. Since its first appearance in December 2019 in the city of Wuhan, Hubei province, China, SARS-CoV-2 infection has quickly spread across the globe, with the first case reported on the African continent, in Egypt on February 14th, 2020. Although the global number of COVID-19 infections has increased exponentially since the beginning of the pandemic, the number of new infections and deaths recorded in African countries have been relatively modest, suggesting slower transmission dynamics of the virus on the continent, a lower-case fatality rate, or simply a lack of testing or reliable data. Notably, there is no significant increase in unexplained pneumonias or deaths on the continent which could possibly indicate the effectiveness of interventions introduced by several African governments. However, there has not yet been a comprehensive assessment of sub-Saharan Africa's (SSA) preparedness and response to the COVID-19 pandemic that may have contributed to prevent an uncontrolled outbreak so far. As a group of early career scientists and the next generation of African scientific leaders with experience of working in medical and diverse health research fields in both SSA and resource-rich countries, we present a unique perspective on the current public health interventions to fight COVID-19 in Africa. Our perspective is based on extensive review of the available scientific publications, official technical reports and announcements released by governmental and non-governmental health organizations as well as from our personal experiences as workers on the COVID-19 battlefield in SSA. We documented public health interventions implemented in seven SSA countries including Uganda, Kenya, Rwanda, Cameroon, Zambia, South Africa and Botswana, the existing gaps and the important components of disease control that may strengthen SSA response to future outbreaks.

15. What works and what does not work in response to COVID-19 prevention and control in Africa

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ABSTRACT

Since the emergence of the COVID-19 pandemic in December 2019 in Wuhan, China, there have been nearly 6,663,304 confirmed cases of COVID-19, including 392,802 deaths, worldwide as of 10:00 CEST 06 June 2020. In Africa, 152,442 COVID-19 cases and 4334 deaths have been reported as of 02 June 2020. The five countries with the highest commutative number of cases in Africa are South Africa, Egypt, Nigeria, Algeria, and Ghana. Africa, and the rest of world, has had to swiftly undertake the necessary measures to protect the continent from irreversible effects of the COVID-19 pandemic that is claiming lives and destroying livelihoods. The lower number of COVID-19 cases in most African countries is attributed to inadequate health systems, low-to-absent testing capacity, poor reporting systems, and insufficient numbers of medical staff. The COVID-19 pandemic poses a great threat to most African countries, from cities to rural areas, and has created a strong demand on already scarce resources. Intense mobilization of additional resources is required to implement established emergency contingency measures. Measures to prevent the spread of COVID-19 include closure of borders and restricting movement of people within a country; this has resulted in the tourism sector being adversely affected by the loss of income. Cooperative prevention and control measures are one of the promising solutions to deplete the spread of COVID-19 on the continent.

16. Rwanda's response during COVID-19

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ABSTRACT

During this coronavirus disease (COVID-19) pandemic, it became apparent the different approaches low- and middle-income countries have taken to engage in both preventative and responsive measures. Rwanda engaged preemptively in these measures starting in late January 2020 and continues to provide regular communication to Rwandans in order to limit the spread of COVID-19. This pandemic has disrupted livelihoods and tested the current mechanisms and resources that Rwanda has to offer. Observations from mental health professionals in Rwanda and community challenges have illustrated the mental health needs that exist. Rwanda's preexisting decentralized health care and mental health care system and its concerted efforts to address people's needs have highlighted the impact of COVID-19 within the country's unique context. Nonetheless, hope is alive and evident in Rwanda through snapshots of ongoing education, community support, collective messages of mental health, and solidarity. The world can gain knowledge from Rwanda's stance in times of uncertainty such as COVID-19 and strive to overcome through national cohesion.

17. Coronaviruses Detected in Bats in Close Contact with Humans in Rwanda

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ABSTRACT

Bats living in close contact with people in Rwanda were tested for evidence of infection with viruses of zoonotic potential. Mucosal swabs from 503 bats representing 17 species were sampled from 2010 to 2014 and screened by consensus PCR for 11 viral families. Samples were negative for all viral families except coronaviruses, which were detected in 27 bats belonging to eight species. Known coronaviruses detected included the betacoronavirus: Kenya bat coronaviruses, Eidolon bat coronavirus, and Bat coronavirus HKU9, as well as an alphacoronavirus, Chaerephon Bat coronavirus. Novel coronaviruses included two betacoronavirus clusters clustering with SARS-CoV, a 2d coronavirus, and an alphacoronavirus.

18. Paramyxo- and Coronaviruses in Rwandan Bats

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ABSTRACT

A high diversity of corona- and paramyxoviruses have been detected in different bat species at study sites worldwide, including Africa, however no biosurveillance studies from Rwanda have been reported. In this study, samples from bats collected from caves in Ruhengeri, Rwanda, were tested for the presence of corona- and paramyxoviral RNA using reverse transcription PCR assays. Positive results were further characterized by DNA sequencing and phylogenetic analysis. In addition to morphological identification of bat species, we also did molecular confirmation of species identities, contributing to the known genetic database available for African bat species. We detected a novel Betacoronavirus in two Geoffroy's horseshoe bats (*Rhinolophus clivosus*) bats. We also detected several different paramyxoviral species from various insectivorous bats. One of these viral species was found to be homologous to the genomes of viruses belonging to the Jeilongvirus genus. Additionally, a Henipavirus-related sequence was detected in an Egyptian rousette fruit bat (*Rousettus aegyptiacus*). These results expand on the known diversity of corona- and paramyxoviruses and their geographical distribution in Africa.

19. Causes of death and predictors of childhood mortality in Rwanda: a matched case-control study using verbal social autopsy

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ABSTRACT

BACKGROUND: Rwanda has dramatically reduced child mortality, but the causes and sociodemographic drivers for mortality are poorly understood.

METHODS: We conducted a matched case-control study of all children who died before 5 years of age in eastern Rwanda between 1st March 2013 and 28th February 2014 to identify causes and risk factors for death. We identified deaths at the facility level and via a community health worker reporting system. We used verbal social autopsy to interview caregivers of deceased children and controls matched by area and age. We used InterVA4 to determine probable causes of death and cause-specific mortality fractions, and utilized conditional logistic regression to identify clinical, family, and household risk factors for death.

RESULTS: We identified 618 deaths including 174 (28.2%) in neonates and 444 (71.8%) in non-neonates. The most commonly identified causes of death were pneumonia, birth asphyxia, and meningitis among neonates and malaria, acute respiratory infections, and HIV/AIDS-related death among non-neonates. Among neonates, 54 (31.0%) deaths occurred at home and for non-neonates 242 (54.5%) deaths occurred at home. Factors associated with neonatal death included home birth (aOR: 2.0; 95% CI: 1.4-2.8), multiple gestation (aOR: 2.1; 95% CI: 1.3-3.5), both parents deceased (aOR: 4.7; 95% CI: 1.5-15.3), mothers non-use of family planning (aOR: 0.8; 95% CI: 0.6-1.0), lack of accompanying person (aOR: 1.6; 95% CI: 1.1-2.1), and a caregiver who assessed the medical services they received as moderate to poor (aOR: 1.5; 95% CI: 1.2-1.9). Factors associated with non-neonatal deaths included multiple gestation (aOR: 2.8; 95% CI: 1.7-4.8), lack of adequate vaccinations (aOR: 1.7; 95% CI: 1.2-2.3), household size (aOR: 1.2; 95% CI: 1.0-1.4), maternal education levels (aOR: 1.9; 95% CI: 1.2-3.1), mothers non-use of family planning (aOR: 1.6; 95% CI: 1.4-1.8), and lack of household electricity (aOR: 1.4; 95% CI: 1.0-1.8).

CONCLUSION: In the context of rapidly declining childhood mortality in Rwanda and increased access to health care, we found a large proportion of remaining deaths occur at home, with home deliveries still representing a significant risk factor for neonatal death. The major causes of death at a population level remain largely avoidable communicable diseases. Household characteristics associated with death included well-established socioeconomic and care-seeking risk factors.

20. The national burden of influenza-associated severe acute respiratory illness hospitalization in Rwanda, 2012-2014

Nyamusore J¹, Rukelibuga J², Mutagoma M¹, Muhire M³, Kabanda A⁴, Williams T⁵, Mutoni A¹, Kamwesiga J¹, Nyatanyi T¹, Omolo J², Kabeja A¹, Koama JB², Mukarurangwa A⁴, Umuringa JA⁴, Granados C⁵, Gasana M⁶, Moen A⁵, Tempia S^{5,7,8}.

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ABSTRACT

BACKGROUND: Estimates of influenza-associated hospitalization are severely limited in low- and middle-income countries, especially in Africa.

OBJECTIVES: To estimate the national number of influenza-associated severe acute respiratory illness (SARI) hospitalization in Rwanda.

METHODS: We multiplied the influenza virus detection rate from influenza surveillance conducted at 6 sentinel hospitals by the national number of respiratory hospitalization obtained from passive surveillance after adjusting for underreporting and reclassification of any respiratory hospitalizations as SARI during 2012-2014. The population at risk was obtained from projections of the 2012 census. Bootstrapping was used for the calculation of confidence intervals (CI) to account for the uncertainty associated with all levels of adjustment. Rates were expressed per 100 000 population. A sensitivity analysis using a different estimation approach was also conducted.

RESULTS: SARI cases accounted for 70.6% (9759/13 813) of respiratory admissions at selected hospitals: 77.2% (6783/8786) and 59.2% (2976/5028) among individuals aged <5 and ≥5 years, respectively. Overall, among SARI cases tested, the influenza virus detection rate was 6.3% (190/3022): 5.7% (127/2220) and 7.8% (63/802) among individuals aged <5 and ≥5 years, respectively. The estimated mean annual national number of influenza-associated SARI hospitalizations was 3663 (95% CI: 2930-4395-rate: 34.7; 95% CI: 25.4-47.7): 2637 (95% CI: 2110-3164-rate: 168.7; 95% CI: 135.0-202.4) among children aged <5 years and 1026 (95% CI: 821-1231-rate: 11.3; 95% CI: 9.0-13.6) among individuals aged ≥5 years. The estimates obtained from both approaches were not statistically different (overlapping CIs).

CONCLUSIONS: The burden of influenza-associated SARI hospitalizations was substantial and was highest among children aged <5 years.

21. Use of administrative records to assess pneumococcal conjugate vaccine impact on pediatric meningitis and pneumonia hospitalizations in Rwanda

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ABSTRACT

BACKGROUND: Ongoing surveillance is critical to assessing pneumococcal conjugate vaccine (PCV) impact over time. However, robust prospective studies are difficult to implement in resource-poor settings. We evaluated retrospective use of routinely collected data to estimate PCV impact in Rwanda.

METHODS: We collected data from admission registers at five district hospitals on children age <5years admitted for suspected meningitis and pneumonia during 2002-2012. We obtained clinical and laboratory data on meningitis from sentinel surveillance at the national reference hospital in Kigali. We developed multivariable logistic regression models to estimate PCV effectiveness (VE) against severe pneumonia and probable bacterial meningitis and Poisson models to estimate absolute rate reductions. Haemophilus influenzae type b vaccine was introduced in January 2002, PCV7 in April 2009 and PCV13 in August 2011.

RESULTS: At the district hospitals, the severe pneumonia and suspected meningitis hospitalization rates decreased by 70/100,000 and 11/100,000 children for 2012 compared to baseline, respectively. VE against severe pneumonia calculated from logistic regression was 54% (95% CI 42-63%). In Kigali, from 2002 to 2012, annual suspected meningitis cases decreased from 170 pre-PCV7 to 40 post-PCV13 and confirmed pneumococcal meningitis cases from 7 to 0. VE against probable bacterial meningitis was 42% (95% CI -4% to 68%).

CONCLUSION: In a resource-poor African setting, analysis of district hospital admission logbooks and routine sentinel surveillance data produced results consistent with more sophisticated impact studies conducted elsewhere. Our findings support applying this methodology in other settings and confirm the benefits of PCV in Rwanda.

22. Decline in Child Hospitalization and Mortality after the Introduction of the 7-Valent Pneumococcal Conjugative Vaccine in Rwanda

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ABSTRACT

Pneumonia is a public health problem in the tropics, and the 7-valent pneumococcal conjugative vaccine (PCV-7) has been introduced in an effort to prevent the disease and therefore reduce childhood mortality. In Rwanda, PCV-7 was introduced in 2009, and we aimed to determine its impact on the rate of child hospitalization/mortality due to pneumonia. A retrospective survey was conducted on hospitalization rates and pediatric deaths between two periods, that is, before the introduction of PCV-7 (2007–2009) and after the introduction of PCV-7 (2010–2013) in Kabutare District Hospital. There was a 53% reduction in hospitalization, with a significant decline in in-hospital deaths between the two periods. There was also a significant correlation between vaccination coverage and decline in hospitalization rates between 2009 and 2013. We conclude that PCV-7 vaccine is associated with significant reduction in the rate of child hospitalization and mortality but more mechanistic studies are warranted to determine the immunological impact, especially in the context of coinfections and malnutrition.

23. Successive introduction of four new vaccines in Rwanda: High coverage and rapid scale up of Rwanda's expanded immunization program from 2009 to 2013

Gatera M¹, Bhatt S², Ngabo F³, Utamuliza M⁴, Sibomana H⁴, Karema C⁵, Mugeni M³, Nutt CT⁶, Nsanzimana S⁴, Wagner CM⁷, Binagwaho A⁸

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ABSTRACT

As the pace of vaccine uptake accelerates globally, there is a need to document low-income country experiences with vaccine introductions. Over the course of five years, the government of Rwanda rolled out vaccines against pneumococcus, human papillomavirus, rotavirus, and measles & rubella, achieving over 90% coverage for each. To carry out these rollouts, Rwanda's Ministry of Health engaged in careful review of disease burden information and extensive, cross-

sectoral planning at least one year before introducing each vaccine. Rwanda's local leaders, development partners, civil society organizations and widespread community health worker network were mobilized to support communication efforts. Community health workers were also used to confirm target population size. Support from Gavi, UNICEF and WHO was used in combination with government funds to promote country ownership and collaboration. Vaccination was also combined with additional community-based health interventions. Other countries considering rapid consecutive or simultaneous rollouts of new vaccines may consider lessons from Rwanda's experience while tailoring the strategies used to local context.

24. Severe Acute Respiratory Illness Deaths in Sub-Saharan Africa and the Role of Influenza: A Case Series From 8 Countries

McMorrow ML¹, Wemakoy EO², Tshilobo JK³, Emukule GO⁴, Mott JA⁵, Njuguna H⁴, Waiboci L⁴, Heraud JM⁶, Rajatonirina S⁶, Razanajatovo NH⁶, Chilombe M⁷, Everett D⁷, Heyderman RS⁷, Barakat A⁸, Nyatanyi T⁹, Rukelibuga J¹⁰, Cohen AL¹¹, Cohen C¹², Tempia S¹³, Thomas J¹⁴, Venter M¹⁵, Mwakapeje E¹⁶, Mponela M¹⁷, Lutwama J¹⁸, Duque J¹⁹, Lafond K²⁰, Nzussouo NT²⁰, Williams T²⁰, Widdowson MA²⁰.

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ABSTRACT

BACKGROUND: Data on causes of death due to respiratory illness in Africa are limited.

METHODS: From January to April 2013, 28 African countries were invited to participate in a review of severe acute respiratory illness (SARI)-associated deaths identified from influenza surveillance during 2009-2012.

RESULTS: Twenty-three countries (82%) responded, 11 (48%) collect mortality data, and 8 provided data. Data were collected from 37 714 SARI cases, and 3091 (8.2%; range by country, 5.1%-25.9%) tested positive for influenza virus. There were 1073 deaths (2.8%; range by country, 0.1%-5.3%) reported, among which influenza virus was detected in 57 (5.3%). Case-fatality proportion (CFP) was higher among countries with systematic death reporting than among those with sporadic reporting. The influenza-associated CFP was 1.8% (57 of 3091), compared with 2.9% (1016 of 34 623) for influenza virus-negative cases ($P < .001$). Among 834 deaths (77.7%) tested for other respiratory pathogens, rhinovirus (107 [12.8%]), adenovirus (64 [6.0%]), respiratory syncytial virus (60 [5.6%]), and *Streptococcus pneumoniae* (57 [5.3%]) were most commonly identified. Among 1073 deaths, 402 (37.5%) involved people aged 0-4 years, 462 (43.1%) involved people aged 5-49 years, and 209 (19.5%) involved people aged ≥ 50 years.

CONCLUSIONS: Few African countries systematically collect data on outcomes of people hospitalized with respiratory illness. Stronger surveillance for deaths due to respiratory illness may identify risk groups for targeted vaccine use and other prevention strategies.

25. Mentoring and quality improvement strengthen integrated management of childhood illness implementation in rural Rwanda

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ABSTRACT

OBJECTIVE: Integrated Management of Childhood Illness (IMCI) is the leading clinical protocol designed to decrease under-five mortality globally. However, impact is threatened by gaps in IMCI quality of care (QOC). In 2010, Partners In Health and the Rwanda Ministry of Health implemented a nurse mentorship intervention Mentoring and Enhanced Supervision at Health Centres (MESH) in two rural districts. This study measures change in QOC following the addition of MESH to didactic training.

DESIGN: Prepost intervention study of change in QOC after 12 months of MESH support measured by case observation using a standardised checklist. Study sample was children age 2 months to 5 years presenting on the days of data collection (292 baseline, 413 endpoint).

SETTING: 21 rural health centres in Rwanda.

OUTCOMES: Primary outcome was a validated index of key IMCI assessments. Secondary outcomes included assessment, classification and treatment indicators, and QOC variability across providers. A mixed-effects regression model of the index was created.

RESULTS: In multivariate analyses, the index significantly improved in southern Kayonza (β -coefficient 0.17, 95% CI 0.12 to 0.22) and Kirehe (β -coefficient 0.29, 95% CI 0.23 to 0.34) districts. Children seen by IMCI-trained nurses increased from 83.2% to 100% ($p < 0.001$) and use of IMCI case recording forms improved from 65.9% to 97.1% ($p < 0.001$). Correct classification improved (56.0% to 91.5%, $p < 0.001$), as did correct treatment (78.3% to 98.2%, $p < 0.001$). Variability in QOC decreased (intracluster correlation coefficient 0.613-0.346).

CONCLUSIONS: MESH was associated with significant improvements in all domains of IMCI quality. MESH could be an innovative strategy to improve IMCI implementation in resource-limited settings working to decrease under-five mortality.

26. A causal loop analysis of the sustainability of integrated community case management in Rwanda

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ABSTRACT

Expansion of community health services in Rwanda has come with the national scale up of integrated Community Case Management (iCCM) of malaria, pneumonia and diarrhea. We used a sustainability assessment framework as part of a large-scale project evaluation to identify factors affecting iCCM sustainability (2011). We then (2012) used causal-loop analysis to identify systems determinants of iCCM sustainability from a national systems perspective. This allows us to develop three high-probability future scenarios putting the achievements of community health at risk, and to recommend mitigating strategies. Our causal loop diagram highlights both balancing and reinforcing loops of cause and effect in the national iCCM system. Financial, political and technical scenarios carry high probability for threatening the sustainability through: (1) reduction in performance-based financing resources, (2) political shocks and erosion of political commitment for community health, and (3) insufficient progress in resolving district health systems--"building blocks"--performance gaps. In a complex health system, the consequences of choices may be delayed and hard to predict precisely. Causal loop analysis and scenario mapping make explicit complex cause-and-effects relationships and high probability risks, which need to be anticipated and mitigated.

27. Nationwide implementation of integrated community case management of childhood illness in Rwanda

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ABSTRACT

BACKGROUND: Between 2008 and 2011, Rwanda introduced integrated community case management (iCCM) of childhood illness nationwide. Community health workers in each of Rwanda's nearly 15,000 villages were trained in iCCM and equipped for empirical diagnosis and treatment of pneumonia, diarrhea, and malaria; for malnutrition surveillance; and for comprehensive reporting and referral services.

METHODS: We used data from the Rwanda health management information system (HMIS) to calculate monthly all-cause under-5 mortality rates, health facility use rates, and community-based treatment rates for childhood illness in each district. We then compared a 3-month baseline period prior to iCCM implementation with a seasonally matched comparison period 1 year after iCCM implementation. Finally, we compared the actual changes in all-cause child mortality and health facility use over this time period with the changes that would have been expected based on baseline trends in Rwanda.

RESULTS: The number of children receiving community-based treatment for diarrhea and pneumonia increased significantly in the 1-year period after iCCM implementation, from 0.83 cases/1,000 child-months to 3.80 cases/1,000 child-months ($P = .01$) and 0.25 cases/1,000 child-months to 5.28 cases/1,000 child-months ($P < .001$), respectively. On average, total under-5 mortality rates declined significantly by 38% ($P < .001$), and health facility use declined significantly by 15% ($P = .006$). These decreases were significantly greater than would have been expected based on baseline trends.

CONCLUSIONS: This is the first study to demonstrate decreases in both child mortality and health facility use after implementing iCCM of childhood illness at a national level. While our study design does not allow for direct attribution of these changes to implementation of iCCM, these results are in line with those of prior studies conducted at the sub-national level in other low-income countries.

28. Institutional frameworks for management of epizoonotic emergencies in six countries in the Eastern Africa region: a situational analysis

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ABSTRACT

INTRODUCTION: The Eastern Africa region is a hot-spot for epidemics of emerging zoonotic diseases ('epizoonotics'). However, the region's capacity for response to epidemics of zoonotic origin has not been documented. This paper presents a multi-country situational analysis on the institutional frameworks for management of zoonotic epidemics in the Eastern Africa region.

METHODS: A multi-country assessment of 6 country teams was conducted (Uganda, Kenya, Tanzania, Ethiopia, DRC and Rwanda). It involved a review of records and interviews with key informants from agencies with a stake in the management of zoonotic and disasters in general in the respective countries. Qualitative data were analyzed for key emerging themes.

FINDINGS: There are many socio-cultural risk factors to epidemic prone zoonotic diseases in the region. Countries have varying levels of preparedness for zoonotic emergencies. All 6 countries have a framework for disaster management. However, technical response to epidemics is managed by the line sectors, with limited Inter-sectoral collaboration. Some sectors were disproportionately more prepared than others. Surveillance systems are mostly passive and inadequate for early detection. All 6 countries have built reasonable capacity to respond to avian influenza, but not other zoonotic emergencies. Most countries lack personnel at the operational levels, and veterinary public health services are ill-facilitated.

CONCLUSION: There is need to strengthen veterinary public health services at all levels, but with a 'one health' approach. There is also need to establish 'risk-based surveillance' hot spots for zoonotic epidemics and to build community resilience 'epizoonotic' diseases.

29. Influenza sentinel surveillance in Rwanda, 2008-2010

Nyatanyi T¹, Nkunda R, Rukelibuga J, Palekar R, Muhimpundu MA, Adeline Kabeja, Kabanda A, Lowrance D, Tempia S, Koama JB, McAlister D, Mukabayire O, Wane J, Raghunathan P, Katz M, Karema C.

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ABSTRACT

BACKGROUND: In 2008, Rwanda established an influenza sentinel surveillance (ISS) system to describe the epidemiology of influenza and monitor for the emergence of novel influenza A viruses. We report surveillance results from August 2008 to July 2010.

METHODS: We conducted ISS by monitoring patients with influenza-like illness (ILI) and severe acute respiratory infection (SARI) at 6 hospitals. For each case, demographic and clinical data, 1 nasopharyngeal specimen, and 1 oropharyngeal specimen were collected. Specimens were tested by real-time reverse-transcription polymerase chain reaction for influenza A and B viruses at the National Reference Laboratory in Rwanda.

RESULTS: A total of 1916 cases (945 ILI and 971 SARI) were identified. Of these, 29.2% (n = 276) of ILI and 10.4% (n = 101) of SARI cases tested positive for influenza. Of the total influenza-positive cases (n = 377), 71.8% (n = 271) were A(H1N1) pdm09, 5.6% (n = 21) influenza A(H1), 7.7% (n = 29) influenza A(H3), 1.6% (n = 6) influenza A (unsubtyped), and 13.3% (n = 50) influenza B. The percentage of positivity for influenza viruses was highest in October -November and February-March, during peaks in rainfall.

CONCLUSIONS: The implementation of ISS enabled characterization of the epidemiology and seasonality of influenza in Rwanda for the first time. Future efforts should determine the population-based influenza burden to inform interventions such as targeted vaccination.

30. 2009 pandemic influenza A (H1N1) virus outbreak and response—Rwanda, October, 2009-May, 2010

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ABSTRACT

BACKGROUND: In October 2009, the first case of pandemic influenza A(H1N1) pdm09 (pH1N1) was confirmed in Kigali, Rwanda and countrywide dissemination occurred within several weeks. We describe clinical and epidemiological characteristics of this epidemic.

METHODS: From October 2009 through May 2010, we undertook epidemiologic investigations and response to pH1N1. Respiratory specimens were collected from all patients meeting the WHO case definition for pH1N1, which were tested using CDC's real time RT-PCR protocol at the Rwandan National Reference Laboratory (NRL). Following documented viral transmission in the community, testing focused on clinically severe and high-risk group suspect cases.

RESULTS: From October 9, 2009 through May 31, 2010, NRL tested 2,045 specimens. In total, 26% (n = 532) of specimens tested influenza positive; of these 96% (n = 510) were influenza A and 4% (n = 22) were influenza B. Of cases testing influenza A positive, 96.8% (n = 494), 3% (n = 15), and 0.2% (n = 1) were A(H1N1) pdm09, Seasonal A(H3) and Seasonal A(non-subtyped), respectively. Among laboratory-confirmed cases, 263 (53.2%) were children <15 years and 275 (52%) were female. In total, 58 (12%) cases were hospitalized with mean duration of hospitalization of 5 days (Range: 2-15 days). All cases recovered and there were no deaths. Overall, 339 (68%) confirmed cases received oseltamivir in any setting. Among all positive cases, 26.9% (143/532) were among groups known to be at high risk of influenza-associated complications, including age <5 years 23% (122/532), asthma 0.8% (4/532), cardiac disease 1.5% (8/532), pregnancy 0.6% (3/532), diabetes mellitus 0.4% (2/532), and chronic malnutrition 0.8% (4/532).

CONCLUSIONS: Rwanda experienced a PH1N1 outbreak which was epidemiologically similar to PH1N1 outbreaks in the region. Unlike seasonal influenza, children <15 years were the most affected by pH1N1. Lessons learned from the outbreak response included the need to strengthen integrated disease surveillance, develop laboratory contingency plans, and evaluate the influenza sentinel surveillance system.

31. Human metapneumovirus infection in wild mountain gorillas, Rwanda

Palacios G¹, Lowenstine LJ, Cranfield MR, Gilardi VK, Spelman L, Lukasik-Braum M, Kinani JF, Mudakikwa A, Nyirakaragire E, Bussetti AV, Savji N, Hutchison S, Egholm M, Lipkin WI.

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ABSTRACT

The genetic relatedness of mountain gorillas and humans has led to concerns about interspecies transmission of infectious agents. Human-to-gorilla transmission may explain human metapneumovirus in 2 wild mountain gorillas that died during a respiratory disease outbreak in Rwanda in 2009. Surveillance is needed to ensure survival of these critically endangered animals.

17 citations
(Sorted by Partner State)

South Sudan



1. Coping with COVID-19 in United Nations peacekeeping field hospitals: increased workload and mental stress for military healthcare providers

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ABSTRACT

INTRODUCTION: This study aimed to explore the impact of COVID-19 on the United Nations peacekeeping field hospitals where medical supply and manpower are extremely insufficient.

METHODS: A level II hospital was deployed in Wau, South Sudan, as the regional referral centre of the United Nations Mission in South Sudan (UNMISS). It had a total strength of 63 personnel with 47 medical staff (average age 38.3±8.0 years, 33 men). A new 'appointment-triage-disinfection' work pattern was adopted to cope with the COVID-19 outbreak in the mission. Data on medical service statistics and workload before/after the outbreak were collected and compared. The mental health of staff was analysed from the quarterly psychological survey, including Perceived Stress Scale (PSS)-10, Generalised Anxiety Disorder (GAD)-7 and Patient Health Questionnaire (PHQ)-9.

RESULTS: The number of outpatients decreased slightly after the COVID-19 outbreak (41.9±11.9 to 37.6±11.8 per week, $p=0.49$), whereas the weekly hospital length of stay of inpatients increased significantly (0.4±1.0 to 3.1±3.9 days, $p=0.02$). Total weekly working hours increased from 1884.9±34.1 to 2023.5±67.3 hours ($p<0.001$). Elevated mental stress (PSS-10: 4.3±2.4 in February to 7.5±3.9 in May, $p<0.001$; GAD-7: 4.0±2.3 to 9.4±4.0, $p<0.001$; PHQ-9: 2.1±1.2 to 3.2±2.4, $p<0.001$) was documented among healthcare providers after the outbreak. The threat of COVID-19 infection, delay in rotation and family-related concerns constituted the main stressors.

CONCLUSION: COVID-19 imposes a huge pressure on peacekeeping field hospitals. Increased workload and mental stress among frontline healthcare providers deserve the attention of UNMISS officials. Facilitating the rotation of the medical staff might potentially improve the operational readiness of the hospital by bringing in well-trained personnel and sufficient medical supplies.

Keywords: health & safety; infection control; infectious diseases; mental health; public health.

2. Impact of Policy and Funding Decisions on COVID-19 Surveillance Operations and Case Reports - South Sudan, April 2020-February 2021

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ABSTRACT

Early models predicted substantial COVID-19-associated morbidity and mortality across Africa (1-3). However, as of March 2021, countries in Africa are among those with the lowest reported incidence of COVID-19 worldwide (4). Whether this reflects effective mitigation, outbreak response, or demographic characteristics, (5) or indicates limitations in disease surveillance capacity is unclear (6). As countries implemented changes in funding, national policies, and testing strategies in response to the COVID-19 pandemic, surveillance capacity might have been adversely affected. This study assessed whether changes in surveillance operations affected reporting in South Sudan; testing and case numbers reported during April 6, 2020-February 21, 2021, were analyzed relative to the timing of funding, policy, and strategy changes. South Sudan, with a population of approximately 11 million, began COVID-19 surveillance in February 2020 and reported 6,931 cases through February 21, 2021. Surveillance data analyzed were from point of entry screening, testing of symptomatic persons who contacted an alert hotline, contact tracing, sentinel surveillance, and outbound travel screening. After travel restrictions were relaxed in early May 2020, international land and air travel resumed and mandatory requirements for negative pre-travel test results were initiated. The percentage of all testing accounted for by travel screening increased >300%, from 21.1% to 91.0% during the analysis period, despite yielding the lowest percentage of positive tests among all sources. Although testing of symptomatic persons and contact tracing yielded the highest percentage of COVID-19 cases, the percentage of all testing from these sources decreased 88%, from 52.6% to 6.3% after support for these activities was reduced. Collectively, testing increased over the project period, but shifted toward sources least likely to yield positive results, possibly resulting in underreporting of cases. Policy, funding, and strategy decisions related to the COVID-19 pandemic response, such as those implemented in South Sudan, are important issues to consider when interpreting the epidemiology of COVID-19 outbreaks.

3. Sero-prevalence of anti-SARS-CoV-2 IgG antibodies in Juba, South Sudan: a population-based study

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ABSTRACT

BACKGROUND: Relatively few COVID-19 cases and deaths have been reported through much of sub-Saharan Africa, including South Sudan, although the extent of SARS-CoV-2 spread remains unclear due to weak surveillance systems and few population-representative serosurveys.

METHODS: We conducted a representative household-based cross-sectional serosurvey in Juba, South Sudan. We quantified IgG antibody responses to SARS-CoV-2 spike protein receptor-binding domain and estimated seroprevalence using a Bayesian regression model accounting for test performance.

RESULTS: We recruited 2,214 participants from August 10 to September 11, 2020 and 22.3% had anti-SARS-CoV-2 IgG titers above levels in pre-pandemic samples. After accounting for waning antibody levels, age, and sex, we estimated that 38.5% (32.1 - 46.8) of the population had been infected with SARS-CoV-2. For each RT-PCR confirmed COVID-19 case, 104 (87-126) infections were unreported. Background antibody reactivity was higher in pre-pandemic samples from Juba compared to Boston, where the serological test was validated. The estimated proportion of the population infected ranged from 30.1% to 60.6% depending on assumptions about test performance and prevalence of clinically severe infections.

CONCLUSIONS: SARS-CoV-2 has spread extensively within Juba. Validation of serological tests in sub-Saharan African populations is critical to improve our ability to use serosurveillance to understand and mitigate transmission.

Keywords: COVID-19; Juba; SARS-CoV-2; South Sudan; antibodies; corona virus disease; influenza; respiratory infections; seroprevalence; serosurvey; severe acute respiratory syndrome coronavirus 2; sub-Saharan Africa; viruses.

4. COVID-19 case management strategies: what are the options for Africa?

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ABSTRACT

The ongoing coronavirus disease 2019 (COVID-19) pandemic has put a strain on health systems globally. Although Africa is the least affected region to date, it has the weakest health systems and an exponential rise in cases as has been observed in other regions, is bound to overwhelm its health systems. Early detection and isolation of suspected and confirmed COVID-19 cases are pivotal to the prevention and control of the pandemic. The World Health Organization (WHO) recommends that all laboratory-confirmed cases should be isolated and treated in a health care facility; however, where this is not possible due to the health system capacity, patients can be isolated in re-purposed facilities or at home. An already very apparent future challenge for Africa is facility-based isolation of COVID-19 cases, given the already limited health infrastructure and health workforce, and the risk of nosocomial transmission. Use of repurposed facilities requires additional resources, including health workers. Home isolation, on the other hand, would be a challenge given the poor housing, overcrowding, inadequate access to water and sanitation, and stigma related to infectious disease that is prevalent in many African societies. Conflict settings on the continent pose an additional challenge to the prevention and control of COVID-19 with the resultant population displacements in overcrowded camps where access to social services is limited. These unique cultural, social, economic and developmental differences on the continent, call for a tailored approach to COVID-19 case management strategies. This article proposes three broad case management strategies based on the transmission scenarios defined by WHO, and the criteria and package of care for each option, for consideration by policy makers and governments in African countries. Moving forward, African countries should generate local evidence to guide the development of realistic home-grown strategies, protocol and equipment for the management of COVID-19 cases on the continent

5. COVID-19 related deaths in Juba, South Sudan: Post mortem Audit January - July 2020

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ABSTRACT

BACKGROUND: With global spread of COVID-19, countries began to develop scientific activities ranging from detection, prevention and control measures to vaccine development. In order to develop sound strategies to mitigate COVID-19 pandemic, there is a need to conduct postmortem audit.

OBJECTIVES: The study is to determine the prevalence of COVID-19 related death in both Juba Military Referral Hospital and Juba Teaching Hospital.

METHODS AND MATERIALS: This is a retrospective post mortem audit study. Data related to corpses were collected from registers of both JMRH and JTH from January to July 2020. Data was cleaned and entered in SPSS version 21 for statistical analysis and variables with $p < 0.05$ were considered statistically significant.

RESULTS: Out of 201 corpses recorded between Jan-July, 72.6% were from JMRH, and 27.4% from JTH. Male were 76.6% and 23.4% female, Age range 21-100 years with mean of 61 years (SD+/- 17.73). Respiratory failure was the leading cause of death (26.9%) $p=0.036$. More than half of the corpses (52.7%) reported, died at hospital while 19.9% community death, 27.4% had no place of death indicated $p=0.001$. Furthermore 39% of the corpses were of age group (61-80 years), while 38.7% of age group (41-60 Years) died due to respiratory failure $p=0.001$

CONCLUSION: This study revealed that higher COVID-19 related death more in males with respiratory failures

Keywords: COVID-19 related death; Respiratory failure; Post-mortem audit; Mortuary; South Sudan

6. The East African Community (EAC) mobile laboratory networks in Kenya, Burundi, Tanzania, Rwanda, Uganda, and South Sudan-from project implementation to outbreak response against Dengue, Ebola, COVID-19, and epidemic-prone diseases

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ABSTRACT

BACKGROUND: East Africa is home to 170 million people and prone to frequent outbreaks of viral haemorrhagic fevers and various bacterial diseases. A major challenge is that epidemics mostly happen in remote areas, where infrastructure for Biosecurity Level (BSL) 3/4 laboratory capacity is not available. As samples have to be transported from the outbreak area to the National Public Health Laboratories (NPHL) in the capitals or even flown to international reference centres, diagnosis is significantly delayed and epidemics emerge.

MAIN TEXT: The East African Community (EAC), an intergovernmental body of Burundi, Rwanda, Tanzania, Kenya, Uganda, and South Sudan, received 10 million € funding from the German Development Bank (KfW) to establish BSL3/4 capacity in the region. Between 2017 and 2020, the EAC in collaboration with the Bernhard-Nocht-Institute for Tropical Medicine (Germany) and the Partner Countries' Ministries of Health and their respective NPHLs, established a regional network of nine mobile BSL3/4 laboratories. These rapidly deployable laboratories allowed the

region to reduce sample turn-around-time (from days to an average of 8h) at the centre of the outbreak and rapidly respond to epidemics. In the present article, the approach for implementing such a regional project is outlined and five major aspects (including recommendations) are described: (i) the overall project coordination activities through the EAC Secretariat and the Partner States, (ii) procurement of equipment, (iii) the established laboratory setup and diagnostic panels, (iv) regional training activities and capacity building of various stakeholders and (v) completed and ongoing field missions. The latter includes an EAC/WHO field simulation exercise that was conducted on the border between Tanzania and Kenya in June 2019, the support in molecular diagnosis during the Tanzanian Dengue outbreak in 2019, the participation in the Ugandan National Ebola response activities in Kisoro district along the Uganda/DRC border in Oct/Nov 2019 and the deployments of the laboratories to assist in SARS-CoV-2 diagnostics throughout the region since early 2020.

CONCLUSIONS: The established EAC mobile laboratory network allows accurate and timely diagnosis of BSL3/4 pathogens in all East African countries, important for individual patient management and to effectively contain the spread of epidemic-prone diseases.

Keywords: BSL4; COVID-19; Capacity building; Dengue fever; East African Community; Ebola virus disease; Mobile laboratory; Outbreak response; Viral haemorrhagic fevers.

7. South Sudan: a young country's fight against COVID-19

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ABSTRACT

COVID-19 is a highly infectious disease that has started to creep into African countries including South Sudan. Following confirmation of the first few cases, the government enacted preventive measures to curb community transmission. However, daunting challenges deter these precautionary measures. Just after two years the country took its independence from Sudan, civil conflicts sparked and continue to overburden and undermine the fragile healthcare system. The conflicts have caused disruption of health services, destruction of health facilities, death and migration of health workers, displacements of a huge number of people. This scenario continues

while the country is grappling with the pandemic. Other concerning issues include: insufficient COVID-19 testing capacity, limited medical and personal protective equipment and an inadequate number of health workers which leave the country ill-equipped in the battle against the pandemic. Non-compliance of COVID-19 prevention protocols by the general public due to high rate of poverty and social stigma contribute to the spread of the virus. The current situation in South Sudan makes evident that there is a need for an immediate ceasefire by the warring sides so the available health services including COVID-19 efforts, are not disrupted to ensure the safety of all. The government needs to further build the capacity of its health sector with the cooperation of its international health allies to be able to provide its citizens with the health services they need.

Keywords: COVID-19; South Sudan; challenges; conflict; health system; responses.

8. The first sixty days of COVID-19 in a humanitarian response setting: a descriptive epidemiological analysis of the outbreak in South Sudan

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ABSTRACT

INTRODUCTION: The corona virus disease 2019 (COVID-19) was declared a pandemic on March 11, 2020. South Sudan, a low-income and humanitarian response setting, reported its first case of COVID-19 on April 5, 2020. We describe the socio-demographic and epidemiologic characteristics of COVID-19 cases in this setting.

METHODS: We conducted a cross-sectional descriptive analysis of data for 1,330 confirmed COVID-19 cases from the first 60 days of the outbreak.

RESULTS: Among the 1,330 confirmed cases, the mean age was 37.1 years, 77% were male, 17% were symptomatic with 95% categorized as mild, and the case fatality rate was 1.1%. Only 24.7% of cases were detected through alerts and sentinel site surveillance, with 95% of the cases reported from the capital, Juba. Epidemic doubling time averaged 9.8 days (95% confidence interval [CI] 7.7 - 13.4), with an attack rate of 11.5 per 100,000 populations. Test positivity rate

was 18.2%, with test rate per 100,000 populations of 53 and mean test turn-around time of 9 days. The case to contact ratio was 1: 2.2.

CONCLUSION: This 2-month initial period of COVID-19 in South Sudan demonstrated mostly young adults and men affected, with most cases reported as asymptomatic. Systems' limitations highlighted included a small proportion of cases detected through surveillance, low testing rates, low contact elicitation, and long collection to test turn-around times limiting the country's ability to effectively respond to the outbreak. A multi-pronged response including greater access to testing, scale-up of surveillance, contact tracing and community engagement, among other interventions are needed to improve the COVID-19 response in this setting.

Keywords: Novel corona virus disease, severe acute respiratory syndrome corona virus 2, epidemiology, humanitarian response setting, South Sudan, Africa

9. A SARS-CoV-2 Surveillance System in Sub-Saharan Africa: Modeling Study for Persistence and Transmission to Inform Policy.

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ABSTRACT

BACKGROUND: Since the novel corona virus emerged in late 2019, the scientific and public health community around the world have sought to better understand, survey, treat, and prevent the disease, COVID-19. In sub-Saharan Africa (SSA), many countries responded aggressively and decisively with lockdown measures and border closures. Such actions may have helped prevent large outbreaks throughout much of the region, though there is substantial variation in caseloads and mortality between nations. Additionally, the health system infrastructure remains a concern throughout much of SSA, and the lockdown measures threaten to increase poverty and food insecurity for the subcontinent's poorest residents. The lack of sufficient testing, asymptomatic infections, and poor reporting practices in many countries limit our understanding of the virus's impact, creating a need for better and more accurate surveillance metrics that account for underreporting and data contamination.

OBJECTIVE: The goal of this study is to improve infectious disease surveillance by complementing standardized metrics with new and decomposable surveillance metrics of COVID-19 that overcome data limitations and contamination inherent in public health surveillance systems. In addition to prevalence of observed daily and cumulative testing, testing positivity rates, morbidity, and mortality, we derived COVID-19 transmission in terms of speed, acceleration or deceleration, change in acceleration or deceleration (*jerk*), and 7-day transmission rate persistence, which explains where and how rapidly COVID-19 is transmitting and quantifies shifts in the rate of acceleration or deceleration to inform policies to mitigate and prevent COVID-19 and food insecurity in SSA.

METHODS: We extracted 60 days of COVID-19 data from public health registries and employed an empirical difference equation to measure daily case numbers in 47 sub-Saharan countries as a function of the prior number of cases, the level of testing, and weekly shift variables based on a dynamic panel model that was estimated using the generalized method of moments approach by implementing the Arellano-Bond estimator in R.

RESULTS: Kenya, Ghana, Nigeria, Ethiopia, and South Africa have the most observed cases of COVID-19, and the Seychelles, Eritrea, Mauritius, Comoros, and Burundi have the fewest. In contrast, the *speed, acceleration, jerk, and 7-day persistence* indicate rates of COVID-19 transmissions differ from observed cases. In September 2020, Cape Verde, Namibia, Eswatini, and South Africa had the highest speed of COVID-19 transmissions at 13.1, 7.1, 3.6, and 3 infections per 100,000, respectively; Zimbabwe had an acceleration rate of transmission, while Zambia had the largest rate of deceleration this week compared to last week, referred to as a *jerk*. Finally, the 7-day persistence rate indicates the number of cases on September 15, 2020, which are a function of new infections from September 8, 2020, decreased in South Africa from 216.7 to 173.2 and Ethiopia from 136.7 to 106.3 per 100,000. The statistical approach was validated based on the regression results; they determined recent changes in the pattern of infection, and during the weeks of September 1-8 and September 9-15, there were substantial country differences in the evolution of the SSA pandemic. This change represents a decrease in the transmission model R value for that week and is consistent with a de-escalation in the pandemic for the sub-Saharan African continent in general.

CONCLUSIONS: Standard surveillance metrics such as daily observed new COVID-19 cases or deaths are necessary but insufficient to mitigate and prevent COVID-19 transmission. Public health leaders also need to know where COVID-19 transmission rates are accelerating or decelerating, whether those rates increase or decrease over short time frames because the pandemic can quickly escalate, and how many cases today are a function of new infections 7 days ago. Even though SSA is home to some of the poorest countries in the world, development and population size are not necessarily predictive of COVID-19 transmission, meaning higher income countries like the United States can learn from African countries on how best to implement mitigation and prevention efforts.

10. Feasibility of Training Clinical Officers in Point-of-Care Ultrasound for Pediatric Respiratory Diseases in Aweil, South Sudan

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ABSTRACT

Lower respiratory tract infections (LRTIs) are the leading cause of deaths in children < 5 years old worldwide, particularly affecting low-resource settings such as Aweil, South Sudan. In these settings, diagnosis can be difficult because of either lack of access to radiography or clinical algorithms that over treat children with antibiotics who only have viral LRTIs. Point-of-care ultrasound (POCUS) has been applied to LRTIs, but not by non-physician clinicians, and with limited data from low-resource settings. Our goal was to examine the feasibility of training the mid-level provider cadre clinical officers (COs) in a Médecins Sans Frontières project in South Sudan to perform a POCUS algorithm to differentiate among causes of LRTI. Six COs underwent POCUS training, and each subsequently performed 60 lung POCUS studies on hospitalized pediatric patients < 5 years old with criteria for pneumonia. Two blinded experts, with a tiebreaker expert adjudicating discordant results, served as a reference standard to calculate test performance characteristics, assessed image quality and CO interpretation. The COs performed 360 studies. Reviewers rated 99.1% of the images acceptable and 86.0% CO interpretations appropriate. The inter-rater agreement (κ) between COs and experts for lung consolidation with air bronchograms was 0.73 (0.63-0.82) and for viral LRTI/bronchiolitis was 0.81 (0.74-0.87). It is feasible to train COs in South Sudan to use a POCUS algorithm to diagnose pneumonia and other pulmonary diseases in children < 5 years old.

11. Burden of Streptococcus pneumoniae and Haemophilus influenzae type b disease in children in the era of conjugate vaccines: global, regional, and national estimates for 2000-15

Brian Wahl ¹, Katherine L O'Brien ², Adena Greenbaum ², Anwasha Majumder ², Li Liu ³, Yue Chu ⁴, Ivana Lukšić ⁵, Harish Nair ⁶, David A McAllister ⁷, Harry Campbell ⁸, Igor Rudan ⁸, Robert Black ⁴, Maria Deloria Knoll ²

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ABSTRACT

BACKGROUND: Pneumococcal conjugate vaccine (PCV) and Haemophilus influenzae type b (Hib) vaccine is now used in most countries. To monitor global and regional progress towards improving child health and to inform national policies for disease prevention and treatment, we prepared global, regional, and national disease burden estimates for these pathogens in children from 2000 to 2015.

METHODS: Using WHO and Maternal and Child Epidemiology Estimation collaboration country-specific estimates of pneumonia and meningitis mortality and pneumonia morbidity from 2000 to 2015, we applied pneumococcal and Hib cause-specific proportions to estimate pathogen-specific deaths and cases. Summary estimates of the proportion of pneumonia deaths and cases attributable to these pathogens were derived from four Hib vaccine and six PCV efficacy and effectiveness study values. The proportion of meningitis deaths due to each pathogen was derived from bacterial meningitis aetiology and adjusted pathogen-specific meningitis case-fatality data. Pneumococcal and Hib meningitis cases were inferred from modeled pathogen-specific meningitis deaths and literature-derived case-fatality estimates. Cases of pneumococcal and Hib syndromes other than pneumonia and meningitis were estimated using the ratio of pathogen-specific non-pneumonia, non-meningitis cases to pathogen-specific meningitis cases from the literature. We accounted for annual HIV infection prevalence, access to care, and vaccine use.

FINDINGS: We estimated that there were 294 000 pneumococcal deaths (uncertainty range [UR] 192 000-366 000) and 29 500 Hib deaths (18 400-40 700) in HIV-uninfected children aged 1-59 months in 2015. An additional 23 300 deaths (15 300-28 700) associated with pneumococcus and fewer than 1000 deaths associated Hib were estimated to have occurred in children infected with HIV. We estimate that pneumococcal deaths declined by 51% (7-74) and Hib deaths by 90% (78-96) from 2000 to 2015. Most children who died of pneumococcus (81%) and Hib (76%) presented with pneumonia. Less conservative assumptions result in pneumococcccal death

estimates that could be as high as 515 000 deaths (302 000-609 000) in 2015. Approximately 50% of all pneumococcal deaths in 2015 occurred in four countries in Africa and Asia: India (68 700 deaths, UR 44 600-86 100), Nigeria (49 000 deaths, 32 400-59 000), the Democratic Republic of the Congo (14 500 deaths, 9300-18 700), and Pakistan (14 400 deaths, 9700-17 000). India (15 600 deaths, 9800-21 500), Nigeria (3600 deaths, 2200-5100), China (3400 deaths, 2300-4600), and South Sudan (1000 deaths, 600-1400) had the greatest number of Hib deaths in 2015. We estimated 3·7 million episodes (UR 2·7 million-4·3 million) of severe pneumococcus and 340 000 episodes (196 000-669 000) of severe Hib globally in children in 2015.

CONCLUSION: The widespread use of Hib vaccine and the recent introduction of PCV in countries with high child mortality is associated with reductions in Hib and pneumococcal cases and deaths. Uncertainties in the burden of pneumococcal disease are largely driven by the fraction of pneumonia deaths attributable to pneumococcus. Progress towards further reducing the global burden of Hib and pneumococcal disease burden will depend on the efforts of a few large countries in Africa and Asia.

12. Prevalence and determinants of pre-lacteal feeding in South Sudan: a community-based survey

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ABSTRACT

BACKGROUND: Pre-lacteal feeding (PLF) is a barrier to optimal breastfeeding and increases the risk of diarrhoea and acute respiratory tract infections in infants. The prevalence and predictors of PLF are not well studied in South Sudan. Understanding the predictors of PLF is crucial in designing interventions to increase exclusive breastfeeding (EBF) rates.

OBJECTIVE: To assess the prevalence and factors associated with PLF in Jubek State, South Sudan.

METHOD: This was a community based cross-sectional study of 810 mothers of children under two years of age in Jubek State, South Sudan. Mothers were interviewed in their homes using a semi-structured questionnaire to collect data on PLF, socio-demographic and birth characteristics. Multivariable analysis was used to identify factors independently associated with PLF.

RESULTS: A total of 426/810 (53 %), 95% confidence interval (CI) [48 %, 59 %] mothers had given pre-lacteal feeds to their infants. The commonest pre-lacteal feeds included glucose solution (54%), water (26%), and infant formula (14%). Having received antenatal breastfeeding counselling decreased the odds of PLF [adjusted odds ratio (AOR) 0.60; 95% CI (0.43, 0.82)]; while discarding of colostrum increased the use of pre-lacteal feeds [AOR 1.57; 95% CI (1.17, 2.11)].

CONCLUSION: The prevalence of PLF in South Sudan is high. Predictors of PLF included lack of breastfeeding counselling and discarding of colostrum. Infant feeding counselling should be given to all pregnant women in the health facilities and communities. The counselling should emphasize the health benefits of colostrum and discourage the practice of discarding it.

Keywords: conflict; infant; newborn; pre-lacteal feeding (PLF); predictors.

13. Adherence to Integrated Management of Childhood Illnesses Guideline in Treating South Sudanese Children with Cough or Difficulty in Breathing

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ABSTRACT

BACKGROUND: Pneumonia substantially kills children aged 2-59 months in South Sudan. However, information on health workers adherence to Integrated Management of Childhood Illnesses (IMCI) guideline in treating children with cough/difficulty in breathing remains scarce. This study assessed factors associated with adherence to IMCI guideline in Aweil East County, South Sudan.

METHODS: This cross-sectional study involved 232 health workers from 36 health facilities. Data collected using structured questionnaire and checklist was double-entered in EpiData and analyzed with STATA at 5% significance level using logistic regression.

RESULTS: Respondents mean age was 32.41 ± 7.0 years, 154 (66.4%) were males, 104 (44.8%) reached secondary education, and 190 (81.9%) had certificate. 23 (9.9%, 95% CI: 6.4-14.5) adhered to IMCI guideline. Holding diploma (adjusted odds ratio (AOR) = 6.97; 95% Confidence Interval (CI): 1.82-26.67; *P* = 0.005), shorter time to follow guideline steps (AOR = 12.0; 95% CI:

2.73-61.66; $P < 0.001$), and nondifficult use (AOR = 27.7; 95% CI: 5.40-142.25; $P < 0.001$) were associated with adherence.

CONCLUSION: Adherence was low. Academic qualifications, guideline complexity, and availability of IMCI drugs were associated factors.

14. Herbal Drugs from Sudan: Traditional Uses and Phytoconstituents

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ABSTRACT

Sudan folklore medicine is characterized by a unique combination of Islamic, Arabic, and African cultures. In poor communities, traditional medicine has remained as the most reasonable source of treatment of several diseases and microbial infections. Although the traditional medicine is accepted in Sudan, to date there is no updated review available, which focuses on most effective and frequently used Sudanese medicinal plants. Thus, this review aims to summarize the published information on the ethnobotanical uses of medicinal plants from Sudan, preparation methods, phytochemistry, and ethnopharmacology. The collected data demonstrate that Sudanese medicinal plants have been reported to possess a wide range of traditional medicinal uses including different microbial infections, gastrointestinal disorders, malaria, diabetes, rheumatic pain, respiratory system disorders, jaundice, urinary system inflammations, wounds, cancer, and different microbial infections. In most cases, the pharmacological studies were in agreement with traditional uses. Moreover, several bioactive compounds such as flavonoids, saponins, alkaloids, steroids, terpenes, tannins, fatty acids, and essential oils have been identified as active constituents. Although this review demonstrates the importance of ethnomedicine medicines in the treatment of several diseases in Sudan, further researches to validate the therapeutic uses and safety of these plants through phytochemical screening, different biological activity assays, and toxicological studies are still needed.

Keywords: Antimicrobial agents, biological activity, medicinal plants, phytoconstituents, Sudan, traditional medicine

15. Pneumonia prevention: Cost-effectiveness analyses of two vaccines among refugee children aged under two years, Haemophilus influenzae type b-containing and pneumococcal conjugate vaccines, during a humanitarian emergency, Yida camp, South Sudan

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ABSTRACT

By September 2013, war between Sudan and South Sudan resulted in >70,000 Sudanese refugees and high pneumonia incidence among the 20,000 refugees in Yida camp, South Sudan. Using Médecins Sans Frontières (MSF)-provided data and modifying our decision-tree models, we estimated if administering Haemophilus influenzae type b (Hib)-containing (pentavalent vaccine, also with diphtheria pertussis and tetanus [DPT] and hepatitis B) and pneumococcal conjugate (PCV) vaccines were cost-effective against hospitalized pneumonia. Among children <2years old, compared with no vaccination, one- and two-doses of combined Hib-containing and PCV would avert an estimated 118 and 125 pneumonia cases, and 8.5 and 9.1 deaths, respectively. The cost per Disability-Adjusted-Life-Year averted for administering combined one- and two-doses was US\$125 and US\$209, respectively. MSF demonstrated that it was possible to administer these vaccines during an emergency and our analysis found it was highly cost-effective, even with just one-dose of either vaccine. Despite unknown etiology, there is strong field and now economic rationale for administering Hib and PCV during at least one humanitarian emergency.

Keywords: Cost-effectiveness; Haemophilus influenzae type b; Hib vaccine; Humanitarian emergency; PCV; Routine immunization; South Sudan; Streptococcus pneumoniae; Supplemental immunization activity.

16. Household air pollution and childhood pneumonia in South Sudan: will clean cooking stoves reduce the incidence and mortality?

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South Sudan Medical Journal Vol 9. No 2. May 2016 MAIN ARTICLE 36

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ABSTRACT

Pneumonia causes more childhood deaths compared to other infectious diseases. Studies have showed that young children exposed to household air pollution (smoke) caused by burning of unprocessed solid fuels such as wood, charcoal, crop waste, animal dung and coal had double the risk of pneumonia infections compared to children who are not exposed or those from families using cleaner fuels such as electricity or gas. In 2012, more than half a million children below the age of 5 years died as a result of exposure to household air pollution worldwide. Based on studies which have indicated that reduction of household air pollution also reduces its health risks such as pneumonia, the World Health Organization recommended the use of cleaner fuels and/or technologies that offer significant health benefits, including the use of clean cooking stoves. Around 99% or all households in South Sudan use solid fuels for cooking in both rural and urban areas. This puts children in South Sudan at risk of pneumonia related deaths attributed to household air pollution. Therefore, promoting the use of clean/improved cook stoves such as the Uga Cooking Stove (locally made in Uganda, using charcoal) is critical to reduce the risk of childhood pneumonia and pneumonia related death in South Sudan.

Key words Household air pollution, childhood pneumonia, South Sudan, clean cooking stoves

17. Carriage rates, circulating serotypes and antibiotic resistance among *Streptococcus pneumoniae* in healthy infants in Yei, South Sudan

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SSMJ Vol 4 No 3 August 2011 Downloaded from www.southsudanmedicaljournal.com

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ABSTRACT

The carriage of *Streptococcus pneumoniae*, serotypes, antimicrobial susceptibility patterns and disease development are poorly understood in Yei. Availability of affordable antibiotics over the counter, lack of laboratory infrastructure and high rates of penicillin resistance have the potential to aggravate rates of childhood mortality associated with *Streptococcus pneumoniae*. There is an urgent need to strengthen microbiological and public health services.

108 citations
(Sorted by Partner State)

Tanzania



1. Determinants of COVID-19 Vaccine Acceptance in Six Lower- and Middle-Income Countries

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Article

ABSTRACT

BACKGROUND: While a vaccine is the only clinical preventive measure to control the infection and mortality caused by SARS, CoV-2 (COVID-19), delayed acceptance or refusal of COVID-19 vaccines may increase and prolong the threat to global public health and the economy. Identifying behavioural determinants is considered a critical step in explaining and addressing the barriers of vaccine refusal, but there is a lack of evidence around COVID-19 vaccine refusal and delay from a behavioural perspective. This study aims to identify the behavioural determinants of COVID-19 vaccine acceptance and provide recommendations to design actionable interventions to increase the uptake of the COVID-19 vaccine in six lower-and-middle income countries.

METHODS: Taking into consideration the Health Belief Model (HBM), Theory of Reasoned Action (TRA), and other behavioural models, a Barrier Analysis (BA) approach was employed to examine twelve potential behavioural determinants of vaccine acceptance in Bangladesh, India, Myanmar, Kenya, the Democratic Republic of Congo, and Tanzania. In all six countries, at least 45 interviews with those who intended to take the vaccine ("Acceptors") and another 45 or more interviews with those who did not ("non-Acceptors") were conducted, totalling 542 interviews. Data analysis was performed to find statistically significant (a p-value of less than 0.05) differences between Acceptors and Non-acceptors and to identify which beliefs were most highly associated with acceptance and non-acceptance of the behaviour based on estimated relative risk (ERR).

RESULTS: The analysis showed that perceived social norms, perceived positive and negative consequences, perceived risk of getting COVID-19, perceived severity of COVID-19, trust in COVID-19 vaccines, perceived safety of COVID-19 vaccines, and expected access to COVID-19 vaccines had the highest association with COVID-19 vaccine acceptance in Bangladesh, Kenya, Tanzania, and DRC. Additional behavioural determinants found to be significant in both Myanmar and India were perceived self-efficacy, trust in COVID-19 information provided by leaders, perceived divine will, and perceived action efficacy of the COVID-19 vaccines. The study also identified important perceptions and beliefs around COVID-19 and its severity, advantages and disadvantages of being vaccinated, and action efficacy of the vaccine to control the spread of the virus.

CONCLUSION: Many of the determinants found to be significant and their level of significance varied from country to country. National and local plans should include messages and activities that address the behavioural determinants found in this study in order to significantly increase the uptake of COVID-19 vaccine across these countries.

Keywords: COVID-19, Vaccine, Hesitancy, Acceptance, Behaviour, Determinants

2. A Qualitative Study on Experiences of HIV Vaccine Trial Participants in a Phase I/II Double Blinded, Randomized Placebo Controlled Clinical Trial in Tanzania: Lessons for COVID-19 Vaccine Testing

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ABSTRACT

BACKGROUND: HIV remains a major public health problem in Sub-Saharan Africa. More than half (54.5%) of all people living with HIV live in Eastern and Southern Africa where 700,000 new infections were reported in 2019. There is no HIV vaccine or cure available yet despite ongoing research to develop one. Uptake of vaccines, when these become available, is critical for its successful introduction in the global society. It is imperative to describe the knowledge, expectations, perceptions and experiences of the vaccines trial participants, as these may be indicative of future vaccine uptake, and may give lessons for COVID-19 vaccine development.

METHODS: A phenomenological qualitative study was conducted to describe the experiences of volunteers who participated in the first HIV vaccine trial in Mbeya, Tanzania. A purposive sample of 20 of the 60 trial participants was interviewed. Interviews were audio-recorded, transcribed, translated, and subjected to thematic-content analysis.

RESULTS: The study showed that trial participation was driven by positive expectations related to health and the realization of the need for an effective vaccine to combat HIV. However, fear, concerns and worries about the safety of the trial vaccine were the frequently reported challenges to participation. Not only participants but also the significant others and community play an important role in the trial participation.

CONCLUSIONS: The success of a trial depends on direct and indirect participation in trials. Future trials, COVID-19 vaccine trials included, must promote positive expectations for trial participation and address fears and concerns related to vaccine safety

Keywords: HIV Vaccine trial, Participant experiences, COVID-19 vaccine trial, trial benefits and challenges, Tanzania

3. South-South humanitarianism: The case of Covid-organics in Tanzania

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ABSTRACT

Tanzania's President sent a plane to Madagascar in May 2020 to bring a shipment of Covid-Organics, a purported cure and prevention for COVID-19. The herbal remedy was described as a gift to help African countries in need. Drawing on preliminary data in English and Kiswahili from unstructured participant observation, social and legacy media available online and shared through contact channels, and ongoing conversations, we explore the Tanzanian policy response to COVID-19. What can the exemplary case of Covid-Organics in Tanzania help us to understand about South-South humanitarian assistance (SSHA) in times of crisis? We suggest that Covid-Organics has enabled the government to project a link to latent debates about Pan-Africanism and Julius Nyerere's legacy and Madagascar's SSHA has provided an opportunity for a public reflection on Africa's place in the world. For some, the remedy's 'Africanness' is its comparative advantage, even promising a continental renaissance. For others, the lack of scientific evidence or approval by global health authorities like WHO is delegitimizing. These findings suggest that receivers of SSHA make sense of it in both a broad, post-colonial discursive context and in a specific context of local contestation. If the promise of this particular form of aid is its ability to transcend deep divisions between North and South, the case of Covid-Organics suggests that SSHA draws on deep ideologies of Pan-Africanism; is increasingly important in crises that are global; and like other forms of humanitarianism, reflects elite politics and priorities rather than prioritizing the distribution of humanitarian goods and decreasing inequality.

Keywords: COVID-19, Tanzania, South-South cooperation, Humanitarianism, Pan-Africanism

4. High prevalence of pre-existing serological cross-reactivity against severe acute respiratory syndrome coronavirus-2 (SARSCoV-2) in sub-Saharan Africa

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ABSTRACT

OBJECTIVE: Significant morbidity and mortality have occurred in the USA, Europe, and Asia due to severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), whereas the numbers of infections and deaths in sub-Saharan Africa (SSA) have remained comparatively low. It has been hypothesized that exposure of the population in SSA to other coronaviruses prior to the COVID-19 pandemic resulted in some degree of cross-protection against SARS-CoV-2 infection and pathogenesis. We evaluated this hypothesis by comparing SARS-CoV-2 cross-reactive antibodies in pre-pandemic plasma samples collected from SSA and the USA.

METHOD: Pre-COVID-19 pandemic plasma samples from SSA and the USA were collected and tested by immunofluorescence assay against the spike and nucleocapsid proteins of all known human coronaviruses (HCoVs).

RESULTS: The prevalence of SARS-CoV-2 serological cross-reactivity was significantly higher in samples from SSA compared with the USA. Most of these cross-reactive samples cross-recognized the SARS-CoV-2 nucleocapsid protein and the spike proteins of other HCoVs. Nucleocapsid proteins from HCoV-NL63 and HCoV-229E were detected in most samples, thereby implicating prior exposure to these two HCoVs as the likely source of cross-reactive antibodies against SARS-CoV-2.

CONCLUSION: The low incidences of SARS-CoV-2 infection and disease in SSA appear to be correlated with the pre-pandemic serological cross-recognition of HCoVs, which are substantially more prevalent in SSA than the USA.

Keywords: SARS-CoV-2, COVID-19, HCoV, Sub-Saharan Africa

5. Otorhinolaryngology services during the COVID-19 pandemic in Tanzania

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ABSTRACT

Coronavirus disease-2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) remains to be a global pandemic and cause of significant morbidity and mortality. Since the mode of transmission of the virus from one person to another is through respiratory droplets, saliva, and fomites, otorhinolaryngologists are highly exposed to COVID-19 while executing their daily functions. Examination of anatomic sites like the nose and throat exposes the otorhinolaryngologist to possible contact with bodily fluids from the patient. Such examination also requires maintenance of close contact with the patient further increasing the exposure risk. Despite the heightened odds of contracting COVID-19 infection during their routine practice, otorhinolaryngologists in Tanzania have continued managing patients while adhering to

the available local guidelines aimed at protecting themselves and also the patients from COVID-19. The aim of this letter is to oversee the current status of otorhinolaryngology services in Tanzania during this era of COVID-19 pandemic.

Keywords: COVID-19, SARS-CoV-2

6. Prevalence of human respiratory syncytial virus, parainfluenza and adenoviruses in East Africa Community partner states of Kenya, Tanzania, and Uganda: A systematic review and meta-analysis (2007–2020)

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ABSTRACT

BACKGROUND: Viruses are responsible for a large proportion of acute respiratory tract infections (ARTIs). Human influenza, parainfluenza, respiratory-syncytial-virus, and adenoviruses are among the leading cause of ARTIs. Epidemiological evidence of those respiratory viruses is limited in the East Africa Community (EAC) region. This review sought to identify the prevalence of respiratory syncytial virus, parainfluenza, and adenoviruses among cases of ARTI in the EAC from 2007 to 2020.

METHODS: A literature search was conducted in Medline, Global Index Medicus, and the grey literature from public health institutions and programs in the EAC. Two independent reviewers performed data extraction. We used a random effects model to pool the prevalence estimate across studies. We assessed heterogeneity with the I² statistic, and Cochran's Q test, and further we did subgroup analysis. This review was registered with PROSPERO under registration number CRD42018110186.

RESULTS: A total of 12 studies met the eligibility criteria for the studies documented from 2007 to 2020. The overall pooled prevalence of adenoviruses was 13% (95% confidence interval [CI]: 6–21, N = 28829), respiratory syncytial virus 11% (95% CI: 7–15, N = 22627), and parainfluenza was 9% (95% CI: 7–11, N = 28363). Pooled prevalence of reported ARTIs, all ages, and locality varied in the included studies. Studies among participants with severe acute respiratory disease had a higher pooled prevalence of all the three viruses. Considerable heterogeneity was noted overall and in subgroup analysis.

CONCLUSION: Our findings indicate that human adenoviruses, respiratory syncytial virus and parainfluenza virus are prevalent in Kenya, Tanzania, and Uganda. These three respiratory viruses contribute substantially to ARTIs in the EAC, particularly among those with severe disease and those aged five and above.

Keywords: Acute respiratory tract infection

7. Women’s Narratives about COVID-19, Preventive Practices and Sources of Information in Northwestern Tanzania

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ABSTRACT

COVID-19 has affected millions of people across the world. We conducted a phone based qualitative study to explore women’s perceptions of COVID-19, knowledge of its symptoms, transmission, and prevention practices in Northwestern Tanzania. We also examined their sources of information about the disease. Findings show that much of women’s framing of etiology, symptoms, and transmission routes of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) greatly reflects the World Health Organization (WHO)/Centers for Diseases Control and Prevention (CDC) frame. Their preventive practices against COVID-19 included the biomedical, cultural, and religious frames, as participants engaged traditional practices and spiritual interventions alongside public health recommendations. Mass media was the main source of information about COVID-19, and one of the trusted sources, in addition to religious and local leaders. To be effective, health promotion programs on pandemics should make more use of the mass media, and communal networks to reach populations.

Keywords: COVID-19; SARS-CoV-2; coronavirus; women; frame analysis; Tanzania

8. Detection profile of SARS-CoV-2 using RT-PCR in different types of clinical specimens: A systematic review and meta-analysis

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ABSTRACT

Testing is one of the commendable measures for curbing the spread of coronavirus disease (COVID-19). But it should be done using the most appropriate specimen and an accurate diagnostic test such as real-time reverse transcription-polymerase chain reaction (qRT-PCR). Therefore, a systematic review was conducted to determine the positive detection rate of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in different clinical specimens using qRT-PCR. A total of 8136 pooled clinical specimens were analyzed to detect SARS-CoV-2, the majority were nasopharyngeal swabs (69.6%). A lower respiratory tract (LRT) specimens had a positive rate (PR) of 71.3% (95% confidence interval [CI]: 60.3%-82.3%) while no virus was detected in the urinogenital specimens. Bronchoalveolar lavage fluid (BLF) specimen had the PR of 91.8% (95% CI: 79.9%-103.7%), followed by rectal swabs; 87.8% (95% CI: 78.6%-96.9%) then sputum; 68.1% (95% CI: 56.9%-79.4%). A low PR was observed in oropharyngeal swabs; 7.6% (95% CI: 5.7%-9.6%) and blood samples; 1.0% (95% CI: -0.1%-2.1%) whereas no SARS-CoV-2 was detected in urine samples. Feces had a PR of 32.8% (95% CI: 15.8%-49.8%). Nasopharyngeal swab, a widely used specimen had a PR of 45.5% (95% CI: 31.2%-59.7%). In this study, SARS-CoV-2 was highly detected in LRT specimens while no virus was detected in urinogenital specimens. BLF had the highest PR followed by rectal swab then sputum. Nasopharyngeal swab which is widely used had moderate PR. Low PR was recorded in oropharyngeal swab and blood samples while no virus was found in urine samples. Last, the virus was detected in feces, suggesting SARS-CoV-2 transmission by the fecal route.

Keywords: clinical sample, clinical specimen, COVID-19, polymerase chain reaction, SARS-CoV-2

9. Contested or complementary healing paradigms? Women's narratives of COVID-19 remedies in Mwanza, Tanzania

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ABSTRACT

BACKGROUND: COVID-19 has caused worldwide fear and uncertainty. Historically, the biomedical disease paradigm established its dominance in tackling emerging infectious illnesses mainly due to innovation in medication and advances in technology. Traditional and religious remedies have emerged as plausible options for prevention and treatment of COVID-19, especially in Africa and Asia. The appeal of religious and traditional therapies against COVID-19 in the African setting must be understood within the historical, social, and political context. This study explored how women and community members dealt with suspected symptoms of COVID-19 in Mwanza, Tanzania.

METHODS: This study was conducted in Nyamagana and Illemela districts of Mwanza, Tanzania, between July and August 2020. We conducted 18 mobile phone in-depth interviews with a purposively selected sample of women aged 27–57 years participating in an existing longitudinal study. For safety reasons, smart mobile phones were used to collect the data. Each interview was audio recorded after obtaining verbal consent from the participants. The audio files were transferred to computers for analysis. Four researchers conducted a multistage, inductive analysis of the data.

RESULTS: Participants reported wide use and perceived high efficacy of traditional remedies and prayer to prevent and treat suspected symptoms of COVID-19. Use was either alone or combined with public health recommendations such as hand washing and crowd avoidance. Despite acknowledging that a pathogen causes COVID-19, participants attested to the relevance and power of traditional herbal medication and prayer to curb COVID-19. Four main factors underline the symbolic efficacy of the traditional and religious treatment paradigms: personal, communal, and official reinforcement of their efficacy; connection to local knowledge and belief systems; the failure of biomedicine to offer a quick and effective solution; and availability.

CONCLUSIONS: In the context of emerging contagious illnesses, communities turn to resilient and trusted treatment paradigms to quell fear and embrace hope. To tackle emerging infections effectively, it is essential to engage the broader sociopolitical landscape, including communal considerations of therapeutic efficacy.

Keywords: COVID-19, SARS-CoV-2, Biomedicine, Traditional medicine, Religious healing, Women, Africa

10. Possible vertical transmission and antibodies against SARS-CoV-2 among infants born to mothers with COVID-19: A living systematic review

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ABSTRACT

Current evidence suggests that coronavirus disease 2019 (COVID-19), caused by severe respiratory syndrome coronavirus 2 (SARS-CoV-2), is predominantly transmitted from human-to-human. However, evidence on vertical transmission and natural passive immunity among the newborns exposed to COVID-19 is scanty and varies. This poses a challenge on preventive interventions for the newborns. We conducted a systematic review to first, determine the likelihood of vertical transmission among COVID-19 exposed infants and second, determine whether antibodies against SARS-CoV-2 were generated among COVID-19 vertically exposed but negative infants. This review registered in PROSPERO searched evidence from PubMed/MEDLINE and Google Scholar, among others. About 517 studies were pooled, where 33 articles (5.8%) met the inclusion criteria such as infection prevention and control measures at birth. A total of 205 infants born to COVID-19 positive mothers were studied. Overall, 6.3% (13/205; 95% CI: 3.0%–9.7%) of the infants tested positive for COVID-19 virus at birth. Of 33 eligible studies, six studies (18.8%) reported about immunoglobulin G/M (IgG/IgM) against SARS-CoV-2. IgG/IgM were detected in 90% infants (10/11; 95% CI: 73.9%–107.9%) who tested negative for COVID-19 virus. The median antibody levels detected were 75.49 AU/ml (range, 7.25–140.32 AU/ml) and 3.79 AU/ml (range, 0.16–45.83 AU/ml), $p = .0041$ for IgG and IgM, respectively. In conclusion, the current evidence revealed a low possibility of vertical transmission of COVID-19 and antibodies against SARSCoV-2 were detected among vertically exposed but negative infants. Further studies on transplacental transmission and the magnitude of natural passive immunity in infants born to mothers with COVID-19 are warranted.

Keywords: antibodies, COVID-19, SARS-CoV-2, vertical transmission

11. Will Tanzania's Wildlife Sector Survive the COVID-19 Pandemic?

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ABSTRACT

The COVID-19 pandemic presents a potential threat to wildlife resources in Africa. In this review, using Tanzania as a case, we examine the impacts and risks that wildlife sectors in Africa are facing or are likely to face as a result of this pandemic. We recognize loss of revenues from tourism as a major impact that could negatively influence the management of wildlife species and habitats. Loss of tourism revenues reduces capacity of the conservation agencies to fund

conservation operations and support the benefit sharing schemes. Furthermore, it undermines the efficacy of conservation to compete with alternative economic activities which are ecologically damaging. Increased unemployment and household poverty due to closure of businesses may exacerbate wildlife crime and unsustainable activities. Additionally, contributions from donor-funding organizations and development partners cannot be guaranteed as revenues may be diverted to support other sectors including health. In order to address and minimize the impacts and reduce the risks to the wildlife sector, the following policy measures are recommended: ensure adequate budget for conservation; develop a crisis management plan; reconsider protocols for conducting wildlife trade; develop a comprehensive tourism recovery plan; promote scientific studies focusing on zoonosis and adopt a One-Health Approach as a matter of urgency in dealing with COVID-19 and future pandemics.

Keywords: Corona virus, COVID-19 pandemic, wildlife, tourism, economic recession, Tanzania

12. Intestinal ischemia in a COVID-19 patient: case report from Northern Tanzania

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ABSTRACT

Novel coronavirus disease 2019 (COVID-19) was first identified in Wuhan, China, and declared by World Health Organization as a pandemic in March 2020. Since then, it has been well known for COVID-19 patients to present with clinical manifestations of severe acute respiratory syndrome (SARS-CoV-2) similar to the influenza. However, in the course of the disease, various pathological complications of high clinical significance have remained unknown. Impaired blood supply to the visceral vascular system can cause serious life-threatening acute damage. We report a case of a 60-year-old female with difficulty in breathing and extensive acute intestinal ischemia confirmed to be associated with SARS-CoV-2 infection. The patient developed a sudden abdominal pain and succumbed shortly after admission before imaging studies were performed. Autopsy revealed massive bowel ischemia. This case highlights the importance of paying attention to serious and less known clinical manifestations other than pulmonary symptoms and fever.

Keywords: SARS-CoV-2, COVID-19

13. Emotional risk assessments in the field: Leaving Tanzania during the COVID-19 pandemic

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ABSTRACT

This article provides a narrative account of one anthropologist's experiences in the field at the onset of the COVID-19 pandemic. The account is based on the researcher's field diary and digital communication, supplemented by online news reports from the period March to May 2020. The researcher's emotional assessments of the risks that COVID-19 posed to herself and others around her stood in sharp contrast to the way her interlocutors in the field responded to the virus. The article makes a case for the empirical value of a researcher's emotions, especially in moments of confusion and feelings of disconnection, in order to understand varying risk perceptions. This article moreover draws attention to the experiences of people living outside the initial epicentres of the pandemic. Many Tanzanians perceived COVID-19 as just one risk among many in their already uncertain daily lives.

Keywords: Emotions, risk, COVID-19, ethnography, positionality, morality

14. The improvement of functional handwashing facilities during COVID-19: the perspective of Tanzania

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ABSTRACT

Fighting against coronavirus disease-2019 (COVID-19) goes hand in hand with the provision of proper water, sanitation, and hygiene (WASH) services. In this case, proper handwashing with soap and water plays a major role in the prevention of COVID-19, since it helps to deactivate and remove virus particles from the hands. This letter points out the drivers for the improvement of functional handwashing facilities during the COVID-19 pandemic in Tanzania, whereby three out of every 20 non-functional handwashing facilities were improved to make them functional. The letter also provides several recommendations to maintain momentum for improving functional handwashing facilities.

Keywords: COVID-19, WASH, Handwashing with soap and water, Tanzania

15. Impacts of COVID-19 on Diverse Farm Systems in Tanzania and South Africa

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ABSTRACT

Emerging information on the interactions between the COVID-19 pandemic and global food systems have highlighted how the pandemic is accentuating food crises across Africa. Less clear, however, are how the impacts differ between farming systems. Drawing on 50 key informant interviews with farmers, village leaders and extension officers in South Africa and Tanzania, we identify the effects of COVID-19 and associated measures to curb the spread of the disease on farming production systems, the coping mechanisms adopted by farmers, and explore their longer-term plans for adaptation. We focus on a diverse range of production systems, from small-scale mixed farming systems in Tanzania to large-scale corporate farms in South Africa. Our findings highlight how COVID-19 restrictions have interrupted the supply chains of agricultural inputs and commodities, increasing the storage time for produce, decreasing income and purchasing power, and reducing labour availability. Farmers' responses were heterogeneous, with highly diverse small-scale farming systems and those less engaged with international markets least affected by the associated COVID-19 measures. Large-scale farmers were most able to access capital to buffer short-term impacts, whereas smaller-scale farms shared labour, diversified to subsistence produce and sold assets. However, compounded shocks, such as

recent extreme climate events, limited the available coping options, particularly for smaller-scale and emerging farmers. The study highlights the need to understand the characteristics of farm systems to better equip and support farmers, particularly in contexts of uncertainty. We propose that policy actions should focus on (i) providing temporary relief and social support and protection to financially vulnerable stakeholders, (ii) job assurance for farmworkers and engaging an alternative workforce in farming, (iii) investing in farming infrastructure, such as storage facilities, digital communication tools and extension services, and (iv) supporting diversified agroecological farming systems.

Keywords: COVID-19; Africa; food systems; agriculture

16. Blood virosphere in febrile Tanzanian children

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ABSTRACT

Viral infections are the leading cause of childhood acute febrile illnesses motivating consultation in sub-Saharan Africa. The majority of causal viruses are never identified in low-resource clinical settings as such testing is either not part of routine screening or available diagnostic tools have limited ability to detect new/unexpected viral variants. An in-depth exploration of the blood virome is therefore necessary to clarify the potential viral origin of fever in children. Metagenomic next-generation sequencing is a powerful tool for such broad investigations, allowing the detection of RNA and DNA viral genomes. Here, we describe the blood virome of 816 febrile children (<5 years) presenting at outpatient departments in Dar es Salaam over one-year. We show that half of the patients (394/816) had at least one detected virus recognized as causes of human infection/disease (13.8% enteroviruses (enterovirus A, B, C, and rhinovirus A and C), 12% rotaviruses, 11% human herpesvirus type 6). Additionally, we report the detection of a large number of viruses (related to arthropod, vertebrate or mammalian viral species) not yet known to cause human infection/disease, highlighting those who should be on the radar, deserve specific attention in the febrile paediatric population and, more broadly, for surveillance of emerging pathogens.

Keywords: Blood virome virosphere metagenomics, next-generation sequencing, fever, children

17. Influenza surveillance capacity improvements in Africa during 2011-2017

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ABSTRACT

BACKGROUND: Influenza surveillance helps time prevention and control interventions especially where complex seasonal patterns exist. We assessed influenza surveillance sustainability in Africa where influenza activity varies and external funds for surveillance have decreased.

METHODS: We surveyed African Network for Influenza Surveillance and Epidemiology (ANISE) countries about 2011-2017 surveillance system characteristics. Data were summarized with descriptive statistics and analysed with univariate and multivariable analyses to quantify sustained or expanded influenza surveillance capacity in Africa.

RESULTS: Eighteen (75%) of 24 ANISE members participated in the survey; their cumulative population of 710 751 471 represent 56% of Africa's total population. All 18 countries scored a mean 95% on WHO laboratory quality assurance panels. The number of samples collected from severe acute respiratory infection case-patients remained consistent between 2011 and 2017 (13 823 vs 13 674 respectively) but decreased by 12% for influenza-like illness case-patients (16 210 vs 14 477). Nine (50%) gained capacity to lineage-type influenza B. The number of countries reporting each week to WHO FluNet increased from 15 (83%) in 2011 to 17 (94%) in 2017.

CONCLUSIONS: Despite declines in external surveillance funding, ANISE countries gained additional laboratory testing capacity and continued influenza testing and reporting to WHO.

These gains represent important achievements toward sustainable surveillance and epidemic/pandemic preparedness.

Keywords: Influenza, surveillance

18. Factors Associated with Mortality Among Hospitalized Adults with COVID-19 Pneumonia at a Private Tertiary Hospital in Tanzania: A Retrospective Cohort Study

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ABSTRACT

BACKGROUND: The emergence of the novel coronavirus disease 2019 (COVID-19) has caused millions of deaths worldwide. There has been paucity of data for hospitalized African patients suffering from COVID-19. This study aimed to identify factors associated with in-hospital mortality in patients suffering from COVID-19 in Tanzania.

METHODS: This was a single center, retrospective, observational cohort study in adult patients hospitalized with confirmed COVID-19 infection. Demographics, clinical pattern, laboratory and radiological investigations associated with increased odds of mortality were analysed.

RESULTS: Of the 157 patients, 107 (68.1%) patients survived and 50 (31.8%) died. Mortality was highest in patients suffering with severe (26%) and critical (68%) forms of the disease. The median age of the cohort was 52 years (IQR 42–61), majority of patients were male (86%) and of African origin (46%), who presented with fever (69%), cough (62%) and difficulty in breathing (43%). Factors that were associated with mortality among our cohort were advanced age (OR 1.07, 95% CI 1.03–1.11), being overweight and obese (OR 9.44, 95% CI 2.71–41.0), suffering with severe form of the disease (OR 4.77, 95% CI 1.18–25.0) and being admitted to the HDU and ICU (OR 6.68, 95% CI 2.06–24.6).

CONCLUSION: The overall in-hospital mortality was 31.8%. Older age, obesity, the severe form of the disease and admission to the ICU and HDU were major risk factors associated with in-hospital mortality.

Keywords: COVID-19, factors, hospital, mortality, Tanzania

19. From Easing Lockdowns to Scaling Up Community-based Coronavirus Disease 2019 Screening, Testing, and Contact Tracing in Africa—Shared Approaches, Innovations, and Challenges to Minimize Morbidity and Mortality

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ABSTRACT

The arrival of coronavirus disease 2019 (COVID-19) on the African continent resulted in a range of lockdown measures that curtailed the spread of the infection but caused economic hardship. African countries now face difficult choices regarding easing of lockdowns and sustaining effective public health control measures and surveillance. Pandemic control will require efficient community screening, testing, and contact tracing; behavioural change interventions; adequate resources; and well-supported, community-based teams of trained, protected personnel. We discuss COVID-19 control approaches in selected African countries and the need for shared, affordable, innovative methods to overcome challenges and minimize mortality. This crisis presents a unique opportunity to align COVID-19 services with those already in place for human immunodeficiency virus, tuberculosis, malaria, and non-communicable diseases through mobilization of Africa's inter-professional healthcare workforce. By addressing the challenges, the detrimental effect of the COVID-19 pandemic on African citizens can be minimized.

Keywords: COVID-19, SARS-CoV-2, screening testing, contact trace, Africa

20. Response of The Social Systems to COVID-19 In Mozambique, Tanzania and Zambia: A Synthesis of the Challenges and Opportunities

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ABSTRACT

OBJECTIVE: This synthesis aimed to assess prevailing social systems and behaviours to identify challenges and opportunities towards COVID-19 responses in Mozambique, Tanzania and Zambia.

METHODS: We searched information using set of broad topic-related terms to include articles and documents reporting country specific information on the identified factions of the social systems. The sources included country specific websites, Pub-Med, Google and Google scholar, with full text documents retrieved from HINARI.

RESULTS: The challenges identified include media's overemphasis of contagious nature of the disease leading into resentment of the infected people in the community; the cultural practices such as greetings by shaking hands and large gatherings in weddings and funerals which are likely to increase risks of transmission of COVID-19; limited access to water challenging hand washing practices; and unreliable income sources to majority of the community members leading to reliance on daily informal activities to earn a living. All such activities make physical distancing less practical. The opportunities included involvement of religious institutions in provision of health education; enhancing risk communication with the public through different digital and traditional media channels; and the extended family living arrangements as protection to vulnerable elderly population.

CONCLUSION: The synthesis has identified several challenges and opportunities of the social system in COVID-19 response in Mozambique, Tanzania and Zambia. The opportunities should be capitalized upon to inform context specific preventive measures and challenges be addressed for prompt prevention of infection transmissions.

Keywords: COVID-19, social systems, Mozambique, Tanzania, Zambia

21. COVID-19 and its Impact on Trade and Transport Sectors in Tanzania

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ABSTRACT

The COVID-19 pandemic has hit the countries around the East African region in different ways with its impact varying across the countries. Also, each country has adopted its approach to dealing with this health crisis, even though they share common borders and also a lot of activities are done across borders, including trade in all sizes. As a result, all sectors whose activities involve crossing borders were heavily affected in different ways mainly due to limitations of the flow of goods and people from one country to another. These problems were amplified by countries' mistrust of the approach used by others in dealing with the pandemic. This study examines the extent to which COVID-19 has affected the trade and transport sectors in Tanzania.

In the trade sector, the study examines the performance of the sector and goes into deep analysis of selected goods. In the transport sector, the study focuses on assessing the effective flow of goods along the central corridor. Also, the tourism sector has been analysed, given that the transport sector is one of its important aspects in its chain. In that manner, the study assesses the tourists' arrival in Zanzibar, which is one of the main sources of Zanzibar's income. Overall, the study analyses the performance of transport and trade sectors in Tanzania before and after the outbreak of the COVID-19 pandemic. This study used secondary data from the Bank of Tanzania (BOT), Tanzania Revenue Authority (TRA), the National Bureau of Statistics (NBS), the Tanzania Ports Authority (TPA) and lastly from the Zanzibar Commission for Tourists and the Department of Immigration Zanzibar. Descriptive statistics were used to capture trends of variables that constituted the trade and transport sectors before and after the outbreak of the COVID-19 pandemic. The findings show that COVID-19 pandemic has impacted the trade and transport sectors differently. In some cases, even within the same sector, different sub-sectors have been affected differently. The trade sector was not very much affected, though imports were relatively more affected. Due to fewer imports during the COVID-19 pandemic, the trade balance was not very much affected like it was in 2019. In the transport sector, port activities were not very much affected by COVID-19 due to measures taken by the port to increase efficiency to reduce congestion that would lead to the spread of the pandemic. However, transit goods were negatively affected due to conditions imposed at borders like mandatory screening and quarantine of travellers for a specified time. Tourism was also negatively affected due to travel restrictions and flight cancellation. To address these challenges, it is useful that countries opt for a common resilient approach to tackle the problem. If, for example, countries opt for mandatory screening, a one-point screening should be sufficient for a driver traveling to other countries within the region. Also, improvement of regional integration in order that trade is mostly done within a region and to a less extent with other countries outside the region. Finally, the promotion of local tourism would help to keep the sector alive during the pandemic, unlike currently where the sector is dominated by foreign tourists. As a result, the sector has suffered heavily simply due to limited movement and entry of foreigners.

Keywords: COVID-19, Transport, Trade, Tanzania

22. Immunogenicity and Efficacy of Pneumococcal Conjugate Vaccine (Prevenar13®) in Preventing Acquisition of Carriage of Pneumococcal Vaccine Serotypes in Tanzanian Children with HIV/AIDS

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ABSTRACT

In every year, up to one million children die due to pneumococcal disease. Children infected with Human Immunodeficiency Virus (HIV) are mostly affected, as they appear to have higher rates of pneumococcal carriage and invasive disease. Successful immunity is dependent on mounting a sufficient immune response to the vaccine. We conducted a double blinded crossover randomised controlled trial to determine the serum antibody response (≥ 4 -fold and geometric mean concentration) to pneumococcal vaccine (PCV13) serotypes at 3 months after second vaccination. We also determined the number and proportion of children carrying new (not present at baseline) vaccine serotypes of *S. pneumoniae* isolated from nasopharynx at 6 months post initial vaccination in recipients of Prevenar13[®] compared with those given *Haemophilus influenzae*-type b (Hib) vaccine (control). The study was conducted at St Augustine's also known as Teule Hospital in Muheza, Tanga Tanzania. 225 HIV infected children aged 1-14 years were enrolled from Jan 2013 to Nov 2013 and randomised to Prevenar13[®] or Hib vaccines each given at baseline and 2-3 months later. Nasopharyngeal and serum samples were collected at baseline and 4-6 months later. Serotyping was done by Quellung Reaction using Statens antisera. Serum antibodies were ELISA quantified. The study revealed a non-significant reduction in the acquisition of new vaccine serotypes of *S. pneumoniae* in the recipients of PCV13 by nearly a third compared to those who received Hib vaccine. The vaccine efficacy was 30.5% (95% confidence interval [CI] -6.4-54.6%, $P = 0.100$). The antibody response was not enough to induce a 4-fold rise in GMC in 7 of the 13 vaccine serotypes. When combining the effects of preventing new acquisition and clearing existing vaccine type carriage, the overall efficacy was 31.5% (95% CI 1.5-52.4%, $P = 0.045$). In the PCV13 group, the proportion of participants carrying vaccine serotype was significantly lower after 2 doses of PCV13 (30%; 32/107), compared with the baseline proportion (48%; 51/107). The introduction of PCV13 targeting HIV-positive children in a setting similar to Tanzania is likely to be associated with appreciable decrease in the acquisition and carriage of pneumococci, which is an important marker of the likely effect of the vaccine on pneumococcal disease.

Keywords: pneumococcal disease, children, Tanzania, vaccine

23. Implications of COVID-19 Pandemic for Higher Education Institutions' Emergency Preparedness, Response and Recovery Mechanism (EPRRM) Contingency Plan: Relating Issues to Tanzania

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https://advance.sagepub.com/articles/preprint/Implications_of_COVID-19_Pandemic_for_Higher_Education_Institutions_Emergency_Preparedness_Response_and_Recovery_Mechanism_EPRRM_Contingency_Plan_Relating_Issues_to_Tanzania/14742771/3
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ABSTRACT

The COVID-19 Pandemic began in China at the end of 2019 and spread rapidly to become a global pandemic by the first quarter of 2020. Many death incidences were reported in a short time before it was being familiar to many nations in terms of practices for containment. In response, many countries had to close down education institutions, lockdown cities, and countries, and emphasize practices of new lifestyles and behaviours thought to guarantee safety. Eventually, students were the most affected groups among the nations. Particularly, the impacts of the pandemic were realized in the teaching and learning processes as well as changes in the practices of administration and management of education services. The impacts were essentially felt by students themselves, professors, instructors, teachers, and educationists in managerial and administrative positions. The high intensities of the impacts escalated as there were no contingency plans to curb the sudden changes and lethality in the instant period of pandemic encounters. The pandemic situation signified the demand for an emergence preparedness, response, and recovery mechanism (EPRRM) contingency plan to be put in place for systems of education. The education EPRRM contingency plan would assist the education machinery in higher learning institutions (HLIs) and other levels of learning to keep in resilient and continual teaching and learning processes in times of crises.

Keywords: COVID-19 Impacts, Teaching, Learning, Administration and management, Higher Learning Institutions, Emergence, Preparedness, Response, Recovery

24. Genetic Determinants of Resistance among ESBL-Producing *Enterobacteriaceae* in Community and Hospital Settings in East, Central, and Southern Africa: A Systematic Review and Meta-Analysis of Prevalence

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ABSTRACT

BACKGROUND: The world prevalence of community and hospital-acquired extended-spectrum β -lactamase (ESBL)-producing *Enterobacteriaceae* is increasing tremendously. Bacteria harboring ESBLs are currently the number one critical pathogens posing a major threat to human health.

OBJECTIVE: To provide a summary of molecular evidence on the prevalence of ESBL-producing *Enterobacteriaceae* (ESBL-E) and associated genes at community and hospital settings in East, Central, and Southern African countries.

METHODS: We conducted a systematic literature search on PubMed and Google Scholar databases for the available molecular studies on ESBL-E in hospitals and community settings in East, Central, and Southern Africa (ECSA). Published studies in English language involving gene characterization of ESBLs from human samples in hospital and community settings were included in the review, inception to November 2019. A random effect meta-analysis was performed to estimate the prevalence of ESBL-E.

RESULTS: A total of 27 studies involving molecular characterization of resistance genes from 20,225 ESBL-E isolates were included in the analysis. Seventy-four percent of all studies were hospital based, 15% were based in community settings, and others were done in both hospital and community settings. Of all the studies, 63% reported *E. coli* as the dominant isolate among ESBL-E recovered from clinical samples and *Klebsiella pneumoniae* was reported dominant isolates in 33% of all studies. A random pooled prevalence of ESBL-E was 38% (95% CI = 24-53%), highest in Congo, 92% (95% CI = 90-94%), and lowest in Zimbabwe, 14% (95% CI = 9-20%). Prevalence was higher in hospital settings 41% (95% CI = 23-58%) compared to community settings 34% (95% CI = 8-60%). ESBL genes detected from clinical isolates with ESBL-E phenotypes in ECSA were those of Ambler molecular class A [1] that belongs to both functional groups 2be and 2d of Bush and Jacob classification of 2010 [2]. Majority of studies ($n=22$, 81.5%) reported predominance of *bla*CTX-M gene among isolates, particularly CTX-M-15. Predictors of ESBL-E included increased age, hospital admissions, previous use of antibiotics, and paramedical use of herbs.

CONCLUSION: Few studies have been conducted at a molecular level to understand the genetic basis of increased resistance among members of ESBL-E in ECSA. Limited molecular studies in the ECSA region leave a gap in estimating the burden and risk posed by the carriage of ESBL genes in these countries. We found a high prevalence of ESBL-E most carrying CTX-M enzyme in ECSA with a greater variation between countries. This could be an important call for combined (regional or global) efforts to combat the problem of antimicrobial resistance (AMR) in the region. Antibiotic use and hospital admission increased the carriage of ESBL-E, while poor people contributed little to the increase of AMR due to lack of access and failure to meet the cost of healthcare compared to high income individuals.

Keywords: Community acquired pneumonia, Tanzania

25. Analysis of Pneumonia Occurrence in Relation to Climate Change in Tanga, Tanzania

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ABSTRACT

In 2018, 70% of global fatalities due to pneumonia occurred in about fifteen countries, with Tanzania being among the top eight countries contributing to these deaths. Environmental and individual factors contributing to these deaths may be multifaceted, but they have not yet been explored in Tanzania. Therefore, in this study, we explore the association between climate change and the occurrence of pneumonia in the Tanga Region, Tanzania. A time series study design was employed using meteorological and health data of the Tanga Region collected from January 2016 to December 2018 from the Tanzania Meteorological Authority and Health Management Information System, respectively. The generalized negative binomial regression technique was used to explore the associations between climate indicators (i.e., precipitation, humidity, and temperature) and the occurrence of pneumonia. There were trend differences in climate indicators and the occurrence of pneumonia between the Tanga and Handeni districts. We found a positive association between humidity and increased rates of non-severe pneumonia (incidence rate ratio (IRR) = 1.01; 95% CI: 1.01–1.02; $p \leq 0.05$) and severe pneumonia (IRR = 1.02; 95% CI: 1.01–1.03; $p \leq 0.05$). There was also a significant association between cold temperatures and the rate of severe pneumonia in Tanga (IRR = 1.21; 95% CI: 1.11–1.33; $p \leq 0.001$). Other factors that were associated with pneumonia included age and district of residence. We found a positive relationship between humidity, temperature, and incidence of pneumonia in the Tanga Region. Policies focusing on prevention and control, as well as promotion strategies relating to climate change-related health effects should be developed and implemented.

Keywords: pneumonia; climate change; rainfall; humidity; temperature; Tanga

26. Correct diagnosis of childhood pneumonia in public facilities in Tanzania: a randomized comparison of diagnostic methods

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ABSTRACT

OBJECTIVE: This study compares two methods for clinical diagnosis of childhood pneumonia that aim to estimate rates of under diagnosis and over diagnosis of childhood pneumonia by examining the sensitivity of Integrated Management of Childhood Diseases implementation in routine care against lung ultrasound (LUS) diagnosis. Setting: We conducted observations in 83

public health facilities (dispensaries, health centres and district hospitals) in Pwani, Dodoma and Tabora, Tanzania between October and December 2017.

METHODS: We used a novel method to estimate rates of under diagnosis and over diagnosis of childhood pneumonia by comparing directly observed public provider diagnoses to the results of diagnoses made by trained clinicians using Mindray DP-10 ultrasound machines. We perform multivariate analysis to identify confounding effects and robustness checks to bound the result. We also explore a number of observable characteristics correlated with higher rates of agreement between provider diagnoses and ultrasound diagnoses.

RESULTS: We observed 93 providers conducting exams on patients aged 2 months–5 years who presented respiratory symptoms or were given a respiratory diagnosis by the provider. Of these 957 patients, 110 were excluded from analysis resulting in a final sample of 847. 17.6% of cases identified as pneumonia via LUS examinations in our sample were diagnosed as pneumonia by providers, suggesting that a significant number of pneumonia cases for which care is sought in the public sector go undiagnosed. Provider knowledge of breath counting and years of experience are positively correlated with higher agreement. While clinical examination rates are not statistically correlated with agreement, it is notable that providers conducted a clinical examination on only about one-third of patients in the sample.

CONCLUSION: Our results suggest that provider training and knowledge of clinical examination protocols for pneumonia diagnosis are predictive of correct diagnosis of pneumonia and should be further explored in future research as a tool for improving quality of care.

Keywords: Pneumonia, Tanzania, Childhood diseases

27. Application of EdTech in Tanzania: Effectiveness of Radio and Television in Teaching and Learning amid COVID-19 Pandemic

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ABSTRACT

On March 2020 School and university going students experienced termination of classes. The statement declared by the Tanzania prime minister honourable Kassim Majaliwa required all primary and secondary schools to postpone learning for a month and one day later universities were also asked to suspend studies and other activities. It was necessary to do so because of the novel coronavirus disease 2019 named by World Health Organisation as COVID-19 a pandemic that had spread and hit more than 150 countries. This paper intended to attain two major objectives, one was to explore the effectiveness of radio and television in handling teaching and learning process as an alternative adopted to ensure that students continue to be engaged

in learning. Second, to examine the capabilities of the country through the Ministry of Education, Science and Technology to continue teaching and learning during the time of classroom disruption. The authors made a case study where radio and television platforms were adopted for teaching and learning. The results show that the transition from classroom teaching and learning to teaching and learning through radio and television stations platform was not effective. Similarly, the study shows that the government has demonstrated incompetence in running and monitoring the programme mostly in terms of programme preparation and implementation. However, this experience has built a solid foundation for the future cases, when the country, facilitators, students and parents will be more arranged than now.

Keywords: EdTech, Teaching and Learning, COVID 19, Radio and Television.

28. Coronavirus disease-2019: is fever an adequate screening for the returning travellers?

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ABSTRACT

On Thursday, 30 January 2020, World Health Organization declared Coronavirus disease-2019 (COVID-2019) a Public Health Emergency of International Concern. Since its identification in late December 2019 in Wuhan, Hubei Province, People's Republic of China, the number of cases imported into other countries is increasing, and the epidemiological map is changing rapidly. On the other hand, body temperature screening (fever) is the major test performed at points of entry, i.e., airports, in the returning travellers in most of the countries with limited resources. However, the recent report on asymptomatic contact transmission of COVID-19 and travellers who passed the symptoms-based screening and tested positive for COVID-19 using reverse transcription polymerase chain reaction (RT-PCR) challenges this approach as body temperature screening may miss travellers incubating the disease or travellers concealing fever during travel. On this note, travel restrictions to and from high-risk areas and/or 14 days quarantine of travellers coming from high-risk areas are recommended to prevent possible importation of COVID-19. Currently, RT-PCR is a reliable test in detecting both symptomatic and asymptomatic COVID-19.

Keywords: COVID-19, Tanzania

29. Impact of COVID-19 on Tanzania Political Economy

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ABSTRACT

Globally, the COVID-19 pandemic has currently spread to more than 185 countries, including African countries. More than 6, 799, 713 confirmed cases of COVID-19 across the globe with 397,388 deaths. In Tanzania, the COVID-19 pandemic has negatively affected the lives of millions of people hence increase the financial burdens in the areas of the agriculture sector, health, hospitality, tourism, education, and Banking sector among others. This paper assessed the political, economic, and social of impact of COVID-19 in Tanzania as well as the Strategy adapted to Mitigating the scourge of the virus. A secondary source (reports, newspapers and Magazines) was utilized as evidence; which were analysed thematically. The data was subjected to thematic content analysis and categorization in line with the objectives of the study. The findings of this study revealed that Tanzanian government is handling the COVID-19 Pandemic in such a way that the country comes first and above everything else. Trade and tourism are seriously affected with more than 60 per cent of Tanzanians at risk of losing their jobs due to COVID-19 Pandemic. Lastly, the government limits the number of passengers from public transports and also reduced schedule for domestic flights. The findings contribute significantly to future research on the COVID-19 challenges on African political economy.

Keywords: COVID-19, Political, Economic, Disruption, Measures

30. Coronavirus: Why Men Are More Vulnerable to Covid-19 Than Women?

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SN Comprehensive Clinical Medicine 2020; 2: 874–876

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ABSTRACT

Amid of coronavirus disease 2019 (Covid-19) pandemic, much emphasis was initially placed on the elderly or those who have pre-existing health conditions such as obesity, hypertension, and diabetes as being at high risk of contracting and/or dying of Covid-19. But it is now becoming clear that being male is also a factor. The epidemiological findings reported across different parts of the world indicated higher morbidity and mortality in males than females. While it is still too early to determine why the gender gap is emerging, this article point to several possible factors such as higher expression of angiotensin-converting enzyme-2 (ACE 2; receptors for coronavirus) in male than female, sex-based immunological differences driven by sex hormone and X chromosome. Furthermore, a large part of this difference in number of deaths is caused by gender behaviour (lifestyle), i.e., higher levels of smoking and drinking among men compared to women. Lastly, studies reported that women had more responsible attitude toward the Covid-19 pandemic than men. Irresponsible attitude among men reversibly affects their undertaking of preventive measures such as frequent handwashing, wearing of face mask, and stay at home orders.

Keywords: SARS-CoV-2, severe acute respiratory syndrome coronavirus 2, MERS-CoV

31. Effects of corona virus pandemic (covid-19) on selected human resource management practices in Tanzania

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ABSTRACT

The global economy has been severally affected by Corona virus (COVID-19) pandemic. Workplace has not been the same because of its connection with the domestic and global economy. Change of lifestyles of customers and employees to cope with the new normal life has caused a crisis that organisations are trying to manage. The effect of the disease on human resource management which is one of core management functions in the corporate world has not been empirically identified. This motivated the researcher to conduct this study. Specifically, the study assessed the effects of COVID-19 on employee recruitment and selection, employee training, performance management and compensation management. Survey design was employed in this study. The study used a sample of 250 human resources practitioners from which data were collected by the use of telephone interviews and an online survey. Data were collected from 6th April, 2020 to 10th May, 2020. Data was analysed using content and descriptive analysis. The study found out that number of employee recruitment and selection activities drastically decreased as a result of COVID-19. Employee training programmes that were scheduled prior to the outbreak had been cancelled to protect employees from contacting the disease. Online training which would be the best alternative could not be used by all organisations because of lack of facilities. Respondents doubted whether e-learning would be as effective as face-to-face mode of training. Performance management became more challenging. The study found that employees could not achieve previous set goals because of disruptions caused by the disease. For organisations that opted for working from home were experiencing difficulties in monitoring employee performance and the practice raised a concern of work-life balance issues. COVID-19 has made organisations to fail meeting some of their financial obligations including payment of employees' benefits. The study recommended adoption of e-HRM to minimize employee physical interactions, employee engagement in crisis management strategies and review of HR policies to suit times of crisis.

Keywords: covid-19, human resource management, practices and Tanzania

32. War against Coronavirus (COVID -19) in Tanzania: Designing a Low Cost Automatic Water Tap.

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Author's information

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ABSTRACT

In December 2019, an outbreak of severe acute respiratory syndrome coronavirus 2 (SARSCoV-2) infection occurred in Wuhan, Hubei Province, China and spread across China and beyond. On February 12, 2020, WHO officially named the disease caused by the novel coronavirus as Coronavirus Disease 2019 (COVID-19). On January 30, 2020, WHO declared COVID-19 as the sixth public health emergency of international concern. One of the major preventions is frequent hand washing. An attempt has been made to design a low-cost automatic water tap as a measure to fight the spread of Coronavirus (Covid-19). The designed system uses simple, easy to get and low-cost instruments. The system does not require a user to touch the water tap. It uses microcontroller to implement intelligence. The solar panel is used as a source of power. The system design uses green solution based automatic water tap. The system will be used in gatherings to avoid Coronavirus spreading. Such gathering places include hospitals, markets, bus stops, public transports, churches, mosques, and restaurants.

Keywords: coronavirus; covid-19; automatic water tap; Wuhan pneumonia; Arduino

33. Diversity of Viruses in Hard Ticks (Ixodidae) from Select Areas of a Wildlife-livestock Interface Ecosystem at Mikumi National Park, Tanzania

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ABSTRACT

Many of the recent emerging infectious diseases have occurred due to the transmission of the viruses that have wildlife reservoirs. Arthropods, such as ticks, are known to be important vectors for spreading viruses and other pathogens from wildlife to domestic animals and humans. In the present study, we explored the diversity of viruses in hard ticks (Ixodidae) from select areas of a wildlife-livestock interface ecosystem at Mikumi National Park, Tanzania using a metagenomic approach. cDNA and DNA were amplified with random amplification and Illumina high-throughput sequencing was performed. The high-throughput sequenced data was imported to the CLC

genomic workbench and trimmed based on quality (Q = 20) and length (≥ 50). The trimmed reads were assembled and annotated through Blastx using Diamond against the National Center for Biotechnology Information non-redundant database and its viral database. The MEGAN Community was used to analyze and to compare the taxonomy of the viral community. The obtained contigs and singletons were further subjected to alignment and mapping against reference sequences. The viral sequences identified were classified into bacteria, vertebrates, and invertebrates, plants, and protozoans viruses. Sequences related to known viral families; Retroviridae, Flaviviridae, Rhabdoviridae, Chuviridae, Orthomyxoviridae, Phenuiviridae, Totiviridae, Rhabdoviridae, Parvoviridae, Caulimoviridae, Mimiviridae and several Phages were reported. This result indicates that there are many viruses present in the study region, which we are not aware of and do not know the role they have or if they have the potential to spread to other species and cause diseases. Therefore, further studies are required to delineate the viral community present in the region over a large scale.

Keywords: Ticks, Viral Metagenomics, Virus, Mikumi National Park

34. Manifold Tactics are used to Control and Prevent Pandemics in Contemporary Africa: A Case of Tanzania's Fight against COVID-19

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ABSTRACT

Since WHO declared coronavirus disease 2019 (COVID-19) a pandemic, some unprecedented measures have been adopted globally to control its transmission. Different countries, Tanzania in particular, are using innovative ways to mitigate COVID-19 impact. The aim of this paper is, therefore, to provide an overview of strategies used to curb coronavirus spread and reducing COVID-19 impact in Tanzania. Information was collected by reviewing different documents including published papers, grey literature, newspapers, media information, formal and informal reports and discussions. Findings show that Tanzania adopted various measures including WHO recommended standard preventive behaviours and practices; spiritual healing; traditional therapies (use of traditional herbs: chewing, drinking as well as steaming). Tanzania has widely been recognized to have strongly achieved fighting COVID-19 where the use of biomedical, experience from successful battles against a number of pandemic infectious diseases, spiritual healing and medicinal herbs individually or in a combination of some sort, which is regarded to have, so far, prevented Tanzania from COVID-19 severity. We conclude, the use and importance of medicinal herbs has long roots among African societies. Traditional medicine or African therapy, therefore, is used alongside or above the modern disease management practices in most of African countries and the developing world. We recommend ongoing medicinal herbs

laboratory tests in Africa and beyond should be encouraged and strengthened for the development of trustworthy, affordable, effective and safe therapies for Africa and the world.

Keywords: Coronavirus, COVID-19, medicinal herbs, traditional medicine, Tanzania

35. The use of proper fabric masks to improve people's health in Tanzania during the COVID-19 pandemic

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A book of policy briefs of studies on implications of COVID-19 pandemic in Tanzania. 2020
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ABSTRACT

Since the first reported case of the Coronavirus (Covid-19) in Tanzania on 16 March 2020, the use of masks was one of the measures the government and health sectors had issued to prevent further spread of the disease. The government and other stakeholders also provided directives on how to produce and use fabric masks not only to meet the high demand for these safety attire by the time but also to protect people from being infected by the virus⁴. The use of locally designed fabric masks was not only well-received by the majority of people, but also made possible for the variety of fabric masks worn in the country. However, the effectiveness of the fabric and their uses in Tanzania is not well established and it is the main objective of this study. The study used electronic sources (YouTube, Instagram, Facebook, WhatsApp, and online related documents) to collect data related to the production and use of fabric masks. In total, 50 images of fabric masks and 10 documents were gathered and analysed in terms of the type of fabric used to make the masks and examine how people wear and sell them. The study findings indicate that different types of fabric used to create these masks, and most of them had been sold in streets by street hawkers popularly known as wamachinga without any protective measures on people's health. The study also observed different styles of wearing masks (some masks are appropriately worn by covering the recommended parts of the face as per health sectors direction. Moreover, the study found that, apart from the official directives given on the use and production of fabric masks, there was no follow-up mechanisms to establish the extent to which these directives were being implemented by both producers and users of fabric masks, to improve people's health in the country during pandemics of viral-respiratory related diseases such as COVID-19. With such observation, this study, therefore, proposes that, Government should develop quality standards for manufacturing of fabric masks in Tanzania by using scientifically approved fabrics and techniques for fabric mask production for COVID-19 pandemic and other related diseases.

Keywords: COVID-19, Tanzania, masks, fabric

36. COVID-19 and stroke in sub-Saharan Africa: case series from Dar es Salaam

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ABSTRACT

Low and middle-income countries including those in sub-Saharan (SSA) Africa are experiencing a steady increase in the number of COVID-19 cases. To the best of our knowledge, reports of COVID-19 related strokes are scarce in SSA. The peculiar situation of stroke care in SSA makes COVID-19 associated stroke a bothersome entity as it adds other dynamics that tilt the prognostic balance. We present a case series of COVID -19 related stroke in 3 patients from Tanzania. We emphasized protected code stroke protocol.

Keywords: Stroke, COVID-19, neurology, Africa, Tanzania, case series

37. Profiling the positive detection rate of SARS-CoV-2 using polymerase chain reaction in different types of clinical specimens: a systematic review and meta-analysis

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ABSTRACT

BACKGROUND: Testing is one of the commendable preventive measures against coronavirus disease (COVID-19), and needs to be done using both most appropriate specimen and an accurate diagnostic test like real time reverse transcription polymerase chain reaction (qRT-PCR). However, the detection rate of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)

RNA from different clinical specimens after onset of symptoms is not yet well established. For guiding the selection of specimens for clinical diagnosis of COVID-19, a systematic review aiming at profiling the positive detection rate from different clinical specimens using PCR was conducted.

METHODS: The systematic search was done using PubMed/MEDLINE, Science direct, Google Scholar, among others. The search included studies on laboratory diagnosis of SARS-CoV-2 from different clinical specimens using PCR. Data extraction was done using Microsoft Excel spreadsheet 2010 and reported according to PRISMA-P guidelines. Using Open Meta Analyst software, DerSimonian–Laird random effects analysis was performed to determine a summary estimate (positive rate [PR]/proportions) and their 95% confidence interval (95%CI).

RESULTS: A total of 8136 different clinical specimens were analyzed to detect SARS-CoV-2, with majority being nasopharyngeal swabs (69.6%). Lower respiratory tract (LRT) specimens had a PR of 71.3% (95%CI:60.3%-82.3%) while no virus was detected from the urinogenital specimens. Bronchoalveolar lavage fluid (BLF) specimen had the PR of 91.8% (95%CI:79.9-103.7%), followed by rectal swabs, 87.8 % (95%CI:78.6%-96.9%) then sputum, 68.1% (95%CI:56.9%-79.4%). Low PR was observed in oropharyngeal swabs, 7.6% (95%CI:5.7%-9.6%) and blood samples, 1.0% (95%CI: -0.1%-2.1%), whilst no SARS-CoV-2 was detected in urine samples. Nasopharyngeal swab, a widely used specimen had a PR of 45.5% (95%CI:31.2%-59.7%).

CONCLUSION: In this study, SARS-CoV-2 was highly detected in lower respiratory tract specimens while there was no detected virus in urinogenital specimens. Regarding the type of clinical specimens, bronchoalveolar lavage fluid had the highest positive rate followed by rectal swab then sputum. Nasopharyngeal swab which is widely used had a moderate detection rate. Low positive rate was recorded in oropharyngeal swab and blood sample while no virus was found in urine samples. More importantly, the virus was detected in feces, suggesting SARS-CoV-2 transmission by the fecal route.

Keywords: severe acute respiratory syndrome coronavirus 2, SARS-CoV-2, COVID-19, Tanzania

38. The first confirmed case of COVID-19 in Tanzania: recommendations based on lesson learned from China

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ABSTRACT

As the coronavirus disease (COVID-19) takes its course outside China, the number of imported cases to other countries is on the rise. Currently, Tanzania has received the first imported case on 16 March 2020. This letter serves to describe this specific event and put forth a number of recommendations including establishing more testing points, discouraging all forms of public and religious gatherings, and tailoring a unique model for lockdown and social distancing to prevent further spread of the disease. The letter has also suggested ways to further improve the efforts already in place so as to strengthen the prevention and control system.

Keywords: Coronavirus disease, Tanzania, China, Recommendations

39. Infection prevention and control compliance in Tanzanian outpatient facilities: a cross-sectional study with implications for the control of COVID-19

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The Lancet Global Health 2020;8(6): e780-e789 [https://doi.org/10.1016/S2214-109X\(20\)30222-9](https://doi.org/10.1016/S2214-109X(20)30222-9)

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ABSTRACT

BACKGROUND: As coronavirus disease 2019 (COVID-19) spreads, weak health systems must not become a vehicle for transmission through poor infection prevention and control practices. We assessed the compliance of health workers with infection prevention and control practices relevant to COVID-19 in outpatient settings in Tanzania, before the pandemic.

METHODS: This study was based on a secondary analysis of cross-sectional data collected as part of a randomised controlled trial in private for-profit dispensaries and health centres and in faith-based dispensaries, health centres, and hospitals, in 18 regions. We observed provider–patient interactions in outpatient consultation rooms, laboratories, and dressing rooms, and categorised infection prevention and control practices into four domains: hand hygiene, glove use, disinfection of reusable equipment, and waste management. We calculated compliance as the proportion of indications (infection risks) in which a health worker performed a correct action, and examined associations between compliance and health worker and facility characteristics using multilevel mixed-effects logistic regression models.

FINDINGS: Between Feb 7 and April 5, 2018, we visited 228 health facilities, and observed at least one infection prevention and control indication in 220 facilities (118 [54%] dispensaries, 66 [30%] health centres, and 36 [16%] hospitals). 18 710 indications were observed across 734

health workers (49 [7%] medical doctors, 214 [29%] assistant medical officers or clinical officers, 106 [14%] nurses or midwives, 126 [17%] clinical assistants, and 238 [32%] laboratory technicians or assistants). Compliance was 6.9% for hand hygiene (n=8655 indications), 74.8% for glove use (n=4915), 4.8% for disinfection of reusable equipment (n=841), and 43.3% for waste management (n=4299). Facility location was not associated with compliance in any of the infection prevention and control domains. Facility level and ownership were also not significantly associated with compliance, except for waste management. For hand hygiene, nurses and midwives (odds ratio 5.80 [95% CI 3.91–8.61]) and nursing and medical assistants (2.65 [1.67–4.20]) significantly outperformed the reference category of assistant medical officers or clinical officers. For glove use, nurses and midwives (10.06 [6.68–15.13]) and nursing and medical assistants (5.93 [4.05–8.71]) also significantly outperformed the reference category. Laboratory technicians performed significantly better in glove use (11.95 [8.98–15.89]), but significantly worse in hand hygiene (0.27 [0.17–0.43]) and waste management (0.25 [0.14–0.44]) than the reference category. Health worker age was negatively associated with correct glove use and female health workers were more likely to comply with hand hygiene.

INTERPRETATION: Health worker infection prevention and control compliance, particularly for hand hygiene and disinfection, was inadequate in these outpatient settings. Improvements in provision of supplies and health worker behaviours are urgently needed in the face of the current pandemic.

Keywords: hand hygiene, coronavirus disease 2019, COVID-19, Tanzania

40. The holistic way of tackling the COVID-19 pandemic: the one health approach

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¹Tropical Medicine and Health (2020) 48:69 <https://doi.org/10.1186/s41182-020-00257-0>

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ABSTRACT

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that is causing a global pandemic had a zoonotic origin in China. Considering the inter-connectedness between human, environment, and animal health, the One Health approach is the appropriate strategy to control and mitigate the effects of the ongoing coronavirus disease 2019 (COVID-19). This letter explains the benefits of the One Health approach and recommends specific measures that could be taken to accelerate the fight against COVID-19 and prevent the spread of newly emerging infectious diseases.

Keywords: COVID-19, SARS-CoV-2, One health approach, Adoption and benefits

41. Adenovirus Infection Is Predicted by Prolonged Duration of Diarrhea among Rotavirus-Vaccinated Children below Five Years of Age in Mwanza, Tanzania

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ABSTRACT

Diarrheal is the commonest cause of morbidity and mortality in many resource-limited countries including Tanzania among children below five years of age. A significant number of diarrhoea cases associated with severe dehydration are still being reported among children despite five years of rotavirus vaccine implementation in Tanzania necessitating the need to investigate other causes of diarrhoea in this population. This study is aimed at determining the prevalence of human adenovirus infection and associated factors among rotavirus-vaccinated children with acute diarrhoea in Mwanza, Tanzania. A cross-sectional study was conducted from June to August 2017 involving 137 children less than two years of age admitted with acute diarrhoea in the health facilities located in Mwanza, Tanzania. Sociodemographic and other relevant information were collected using standardized rotavirus surveillance tool adopted from WHO. Stool specimens were collected and tested for human adenovirus antigen using immunochromatographic tests. Data were analysed by using STATA version 13. The median age of enrolled children was 12 (IQR 8-17) months. The prevalence of human adenovirus was found to be 46 (33.6%, 95% CI: 25-41). By multivariable logistic regression analysis, only prolonged duration of diarrhoea (OR: 1.619, 95% CI: 1.142-2.295; $p = 0.007$) was found to predict human adenovirus infection among rotavirus-vaccinated children with acute diarrhoea. A significant proportion of rotavirus-vaccinated children with prolonged acute diarrhoea have adenovirus infection. There is a need to consider other viral pathogens as potential cause of diarrhoea especially in this postrotavirus vaccination period.

Keywords: Diarrhea, Adenoviruses, rotavirus, vaccine, Tanzania

42. Genetic characterization of treponema pallidum isolates and detection of viruses of human health relevance in Free-ranging non-human primates of Tanzania

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ABSTRACT

Treponema pallidum is a group of non-cultivable spiral bacteria that cause treponematoses in humans in Europe and non-human primates (NHPs) since 1490s and 1960s, respectively. In humans, *T. pallidum pallidum* causes syphilis, *T. pallidum endemicum* is responsible for endemic syphilis and *T. pallidum pertenuis* for yaws. The latter also infects various NHP species in Africa and elsewhere in the world. Historically, Tanzania is among 84 yaws-endemic countries that currently have little data available due to scanty research on treponematoses, both in humans and wild NHPs. In Tanzania, TPE infection has not been studied in NHPs other than olive baboons of Lake Manyara and Serengeti National Parks (Knauf, 2011; Harper et al., 2012). Therefore, the current study was conducted from 2015 to 2017 across different ecosystems of Tanzania to investigate TPE infection in 289 free-ranging NHPs (eight species) and genetically characterize the TPE isolates. Using serologic treponemal test (Espline TP), this study detected anti- *T. pallidum* antibodies and showed that *Treponema pallidum* (TP) infection is geographically widespread in Tanzanian NHPs. The overall mean seropositivity was 53.3% (154/289) of which 60.7% (82/135) were females and males 46.8% (72/154) males. The NHPs tested included: vervet monkeys (77.8%, 35/45), olive baboons (85/137, 62.0%), yellow baboons (33/75, 44.0%) and blue monkeys (1/15, 6.7%). Three independent PCRs (polA, tp47, and TP_0619) confirmed these results but picked up 2 more positive cases missed by serology boosting the positivity to about 54% of NHPs (156/289) with four out of eight species testing positive at 11 of 14 locations. Majority of infected NHPs (59.8% ± 23.9% yellow baboons at 6 sites; 45.6% ± 16.2% olive baboons and 31.6% ± 9.4% vervet monkeys at 9 sites) had significantly more ($p < 0.001$) anogenital ulcerations than orofacial lesions (3.5% olive baboons at Lake Manyara). Presence of antibodies against *T. pallidum* significantly associated with skin ulcerations in olive baboons ($p < 0.0001$) and yellow baboons ($p = 0.0185$). Multi-Locus Sequence Typing (MLST) analysis of three genes (Tp0488, Tp0548 and Tp0619) revealed genetically diverse simian TPE strains in Tanzania and all the strains were closely related to TPE responsible for human yaws. Phylogenetic analysis showed geographical clustering of TPE strains, suggesting rare interspecies transmission. The strains had relative temporal stability and infection by multi-strain was evident. Antibiotic resistance was not found in Tanzanian NHPs. Serological analysis of randomly selected 74 NHPs using indirect immunofluorescence test (IIFT)-Chip technology (Euroimmun), detected antibodies reactive or cross reactive with 13 full viral antigens out of 20 that represent twelve virus families. These were: measles virus (89.2%, $n = 66$), mouse hepatitis virus (78.4%, $n = 58$), mouse rotavirus (73.0%, $n = 54$), H1N1 Singapore (48.6%, $n = 36$), yellow fever virus (37.8%, $n = 28$), dengue virus (23.0%, $n = 17$), adenovirus type 3 (21.6%, $n = 16$) and parainfluenza 2 virus (10.8%, $n = 8$). None of the Tanzanian NHPs reacted with antigens from the rest seven viruses, including Ebola virus. Seropositivity of the NHPs to *T. pallidum* could not be linked to reaction or crossreaction with any of the investigated viruses. More studies to further characterize simian and human pathogenic TPEs across Tanzania and Africa are highly recommended so as in the use of more specific tests in studies detecting and identifying simian viruses of human health significance.

Keywords: Viruses, Human, Tanzania

43. Promotion of unproved and potential dangerous measures in fighting COVID-19 pandemic: urgent need for vigilant appropriate public communication and generation of scientific evidence

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ABSTRACT

The ultimate cure for COVID-19 has not yet been discovered, but there is a lot of promoted traditional and food supplements claimed to be effective against the disease. Some of the promoted measures are not only associated with other adverse health outcome, but also create a sense of false protection; leading to failure to follow appropriate measures. It is crucial to identify, correct this misinformation, and to conduct clinical trials to generate evidence among those which are scientifically sound.

Keywords: COVID-19

44. Tailoring of the ongoing water, sanitation and hygiene interventions for prevention and control of COVID-19

Vivian Mushi¹ and Magdalena Shao²

Tropical Medicine and Health 2020; 48:47 <https://doi.org/10.1186/s41182-020-00236-5>

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ABSTRACT

Water, sanitation, and hygiene (WASH) interventions remain to be important in the prevention of further spread of coronavirus disease-2019 (COVID-19). Basic hygiene interventions such as handwashing with water and soap (HWWS) when applied consistently will deactivate and remove the virus particles from the hands. Realizing the efforts that have been made by countries world over in controlling the COVID-19, this letter seeks to discuss how the available WASH services can be used in the fight against further spread of COVID-19. The letter highlights the challenges being faced by the current WASH services in middle- and low-income countries and suggests measures that can be employed to strengthen the WASH services in this period of the COVID-19 pandemic.

Keywords: COVID-19, WASH, HWWS, Interventions and challenges

45. Guillain-Barré syndrome associated with COVID-19 infection

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ABSTRACT

We are reporting a case of Acute Post-Infectious Flaccid paralysis also commonly known as Guillain-Barré Syndrome (GBS) in a patient with confirmed COVID-19 infection. GBS often occurs following an infectious trigger which induces autoimmune reaction causing damage to peripheral nerves. So far, only 8 cases have been described in association with COVID-19. This is the first to be described in Tanzania in an African Child, and probably the first in the continent. This report is presented for clinicians to be aware and for the medical fraternity to look into this unusual presentation which may shed some more light on possible pathways of the pathogenesis and clinical manifestations. We recommend that the presentation of GBS with acute respiratory distress should warrant extra precaution and a testing for COVID-19 especially when the symptoms of COVID-19 are protean.

Keywords: infectious flaccid paralysis, COVID-19, Tanzania

46. Postoperative myocardial injury in a patient with left ureteric stone and asymptomatic COVID-19 disease

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ABSTRACT

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It was first identified on 8th December 2019 in Wuhan, Hubei, China, and has since spread globally to become an emergency of international concern. Patients infected with SARS-CoV-2 may be asymptomatic or present with symptoms ranging from mild clinical manifestations: such as fever, cough, and sore throat to moderate and severe form of the disease such as pneumonia and acute respiratory distress syndrome (ARDS). In some patients, SARS-CoV-2 can affect the heart and cause myocardial injury which is evidenced either by electrocardiographic (ECG) changes or by a rise in serum troponin level. Patients with myocardial involvement are generally at risk of developing severe illness and tend to have a poor outcome. We hereby present a case of a hypertensive male patient with undiagnosed, asymptomatic COVID-19, who underwent an emergency urologic procedure for ureteric calculi. He eventually sustained a postoperative myocardial injury resulting in his demise. This case highlights the importance of detailed preoperative assessment and anticipation of complications during this global pandemic.

Keywords: Coronavirus disease 2019 (COVID-19), severe acute respiratory syndrome coronavirus 2, myocardial infarction, ureteric calculi

47. Preparedness of health facilities providing HIV services during COVID-19 pandemic and assessment of their compliance to COVID-19 prevention measures: findings from the Tanzania Service Provision Assessment (SPA) survey

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Pan African Medical Journal. 2020;37(1):18. 10.11604/pamj.supp.2020.37.1.25443

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ABSTRACT

INTRODUCTION: the increased demands of health facilities and workers due to coronavirus overwhelm the already burdened Tanzanian health systems. This study evaluates the current capacity of facilities and providers for HIV care and treatment services and their preparedness to adhere to the national and global precaution guidelines for HIV service providers and patients.

METHODS: data for this study come from the latest available, Tanzania Service Provision Assessment survey 2014-15. Frequencies and percentages described the readiness and availability of HIV services and providers. Chi-square test compared the distribution of services by facility location and availability and readiness of precaution commodities and HIV services by managing authorities.

RESULTS: availability of latex gloves was high (83% at OPD and 95.3% laboratory). Availability of medical masks, alcohol-based hand rub and disinfectants was low. Availability of medical mask at outpatient department (OPD) was 28.7% urban (23.5% public; 33.8% private, $p=0.02$) and 13.5% rural (10.1% public; 25.4% private, $p=0.001$) and lower at laboratories. Fewer facilities in rural area (68.4%) had running water in OPD than urban (86.3%). Higher proportions of providers at public than private facilities in urban (82.8% versus 73.1%) and rural (88.2% versus 81.6%) areas provided HIV test counseling and at least two other HIV services.

CONCLUSION: availability of commodities such as medical masks, alcohol-based hand rub, and disinfectant was low while the readiness of providers to multitask HIV related services was high. Urgent distribution and re-assessment of these supplies are necessary, to protect HIV patients, their caregivers, and health providers from COVID-19.

Keywords: Tanzania, COVID-19, HIV, health system

48. Coronavirus disease-2019: is fever an adequate screening for the returning travelers?

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Tropical Medicine and Health 2020; 48:14 <https://doi.org/10.1186/s41182-020-00201-2>

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ABSTRACT

On Thursday, 30 January 2020, World Health Organization declared Coronavirus disease-2019 (COVID-2019) a Public Health Emergency of International Concern. Since its identification in late December 2019 in Wuhan, Hubei Province, People's Republic of China, the number of cases imported into other countries is increasing, and the epidemiological map is changing rapidly. On the other hand, body temperature screening (fever) is the major test performed at points of entry, i.e., airports, in the returning travelers in most of the countries with limited resources. However, the recent report on asymptomatic contact transmission of COVID-19 and travelers who passed the symptoms-based screening and tested positive for COVID-19 using reverse transcription polymerase chain reaction (RT-PCR) challenges this approach as body temperature screening may miss travelers incubating the disease or travelers concealing fever during travel. On this note, travel restrictions to and from high risk areas and/or 14 days' quarantine of travelers coming from high risk areas are recommended to prevent possible importation of COVID-19. Currently, RT-PCR is a reliable test in detecting both symptomatic and asymptomatic COVID-19.

Keywords: COVID-19, Fever, Returning travelers, Temperature screening

49. Mathematical modelling on COVID-19 transmission impacts with preventive measures: a case study of Tanzania

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ABSTRACT

The outbreak of COVID-19 was first experienced in Wuhan City, China, during December 2019 before it rapidly spread over globally. This paper has proposed a mathematical model for studying its transmission dynamics in the presence of face mask wearing and hospitalization services of human population in Tanzania. Disease-free and endemic equilibria were determined and subsequently their local and global stabilities were carried out. The trace-determinant approach was used in the local stability of disease-free equilibrium point while Lyapunov function technique was used to determine the global stability of both disease-free and endemic equilibrium points. Basic reproduction number, R_0 , was determined in which its numerical results revealed that, in the presence of face masks wearing and medication services or hospitalization as preventive measure for its transmission, $R_0 = 0.698$ while in their absence $R_0 = 3.8$. This supports its analytical solution that the disease-free equilibrium point E_0 is asymptotically stable whenever $R_0 < 1$, while endemic equilibrium point E^* is globally asymptotically stable for $R_0 > 1$. Therefore, this paper proves the necessity of face masks wearing and hospitalization services to COVID-19 patients to contain the disease spread to the population

Keywords: COVID-19; basic reproduction number; equilibrium points and stability.

50. Challenges to peer support in low- and middle-income countries during COVID-19

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ABSTRACT

BACKGROUND: A recent editorial urged those working in global mental health to “change the conversation” on coronavirus disease (Covid-19) by putting more focus on the needs of people with severe mental health conditions. UPSIDES (Using Peer Support In Developing Empowering mental health Services) is a six-country consortium carrying out implementation research on peer support for people with severe mental health conditions in high- (Germany, Israel), lower middle- (India) and low-income (Tanzania, Uganda) settings. This commentary briefly outlines some of the key challenges faced by UPSIDES sites in low- and middle-income countries as a result of

Covid-19, sharing early lessons that may also apply to other services seeking to address the needs of people with severe mental health conditions in similar contexts.

CHALLENGES AND LESSONS LEARNED: The key take-away from experiences in India, Tanzania and Uganda is that inequalities in terms of access to mobile technologies, as well as to secure employment and benefits, put peer support workers in particularly vulnerable situations precisely when they and their peers are also at their most isolated. Establishing more resilient peer support services requires attention to the already precarious situation of people with severe mental health conditions in low-resource settings, even before a crisis like Covid-19 occurs. While it is essential to maintain contact with peer support workers and peers to whatever extent is possible remotely, alternatives to face-to-face delivery of psychosocial interventions are not always straightforward to implement and can make it more difficult to observe individuals' reactions, talk about emotional issues and offer appropriate support.

CONCLUSIONS: In environments where mental health care was already heavily medicalized and mostly limited to medications issued by psychiatric institutions, Covid-19 threatens burgeoning efforts to pursue a more holistic and person-centered model of care for people with severe mental health conditions. As countries emerge from lockdown, those working in global mental health will need to redouble their efforts not only to make up for lost time and help individuals cope with the added stressors of Covid-19 in their communities, but also to regain lost ground in mental health care reform and in broader conversations about mental health in low-resource settings.

Keywords: Peer support, Global mental health, Covid-19

51. Knowledge, attitudes, and practices (KAP) towards COVID-19: A quick online cross-sectional survey among Tanzanian residents.

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ABSTRACT

BACKGROUND: In Tanzania, Unprecedented measures have been adopted to control the rapid spread of the ongoing COVID-19 epidemic. Residents adherence to control measures is affected by their knowledge, attitudes, and practices (KAP) towards COVID-19. In this study, we investigated Tanzanian residents' KAP towards COVID-19 during the rapid rise period of the outbreak.

METHODS: This was a cross sectional study that involved sample of online Tanzanian residents who was recruited via authors networks with residents and social media. A self-developed online KAP questionnaire using Survey Monkey tool was used to collect data from participants. The questionnaire assessed demographic and had 12 questions on COVID Knowledge and 5

questions on attitude and practice. Descriptive and inferential analysis was carried out using SPSS 17.

RESULTS: Four hundred residents completed a survey. The mean age of study participants was 28 years, and majorities were females 216 (54.0%). There was no significant difference in relation to demographic variables ($p>0.3$). Those who held a bachelor degree or above (60.3%) had more correct score. The overall, (84.4%) of participants had good knowledge level and the good knowledge was associated with education level ($p=0.001$). Nearly all of the participants (96.0%) had confidence that Tanzania can win the battle against COVID-19. The majority of the respondents (77%) did not do to the crowded place in recent days. Multiple linear regression analysis showed that male gender, age-group of 16-29 years and education of secondary or lower were significantly associated with lower knowledge score.

CONCLUSION: Our findings suggest that residents of a relatively high level of socioeconomic status, have had good knowledge, optimistic attitudes, and appropriate practices towards COVID-19 during the rapid rise period of the COVID-19 outbreak. Suggesting that health education programs aimed at improving COVID-19 knowledge are helpful for encouraging an optimistic attitude and maintaining safe practices. Due to the limitation in representativeness of the sample, more studies are warranted to investigate the KAP towards COVID-19 among Tanzania residents of a low socioeconomic status.

Keywords: Knowledge, Attitude, Practice, COVID-19, Tanzania

52. Oral and maxillofacial surgical services amid COVID-19 pandemic: perspective from Tanzania

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ABSTRACT

The coronavirus disease 2019 (COVID-19) caused by the severe acute respiratory syndrome coronavirus 2 is a global pandemic that affects individuals from all walks of life. Considering that the virus can be passed on directly from person to person through respiratory droplets, contact, fomites, and saliva, the oral and maxillofacial surgeons are exposed to COVID-19 in their daily clinical duties. This is because of the nature of their work, which entails working within a short distance from patients' oral cavity and upper airway. As such, there is a need for having locally tailored standard guidelines for managing patients with oral and maxillofacial conditions during the COVID 19 pandemic in Tanzania.

Keywords: COVID-19, Oral and maxillofacial surgery, Tanzania

53. Infection prevention and control compliance in Tanzanian outpatient facilities: a cross-sectional study with implications for the control of COVID-19

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ABSTRACT

BACKGROUND: As coronavirus disease 2019 (COVID-19) spreads, weak health systems must not become a vehicle for transmission through poor infection prevention and control practices. We assessed the compliance of health workers with infection prevention and control practices relevant to COVID-19 in outpatient settings in Tanzania, before the pandemic.

METHODS: This study was based on a secondary analysis of cross-sectional data collected as part of a randomized controlled trial in private for-profit dispensaries and health centres and in faith-based dispensaries, health centres, and hospitals, in 18 regions. We observed provider–patient interactions in outpatient consultation rooms, laboratories, and dressing rooms, and categorized infection prevention and control practices into four domains: hand hygiene, glove use, disinfection of reusable equipment, and waste management. We calculated compliance as the proportion of indications (infection risks) in which a health worker performed a correct action, and examined associations between compliance and health worker and facility characteristics using multilevel mixed-effects logistic regression models.

FINDINGS: Between Feb 7 and April 5, 2018, we visited 228 health facilities, and observed at least one infection prevention and control indication in 220 facilities (118 [54%] dispensaries, 66 [30%] health centres, and 36 [16%] hospitals). 18 710 indications were observed across 734 health workers (49 [7%] medical doctors, 214 [29%] assistant medical officers or clinical officers, 106 [14%] nurses or midwives, 126 [17%] clinical assistants, and 238 [32%] laboratory technicians or assistants). Compliance was 6·9% for hand hygiene (n=8655 indications), 74·8% for glove use (n=4915), 4·8% for disinfection of reusable equipment (n=841), and 43·3% for waste management (n=4299). Facility location was not associated with compliance in any of the infection prevention and control domains. Facility level and ownership were also not significantly associated with compliance, except for waste management. For hand hygiene, nurses and midwives (odds ratio 5·80 [95% CI 3·91–8·61]) and nursing and medical assistants (2·65 [1·67–4·20]) significantly outperformed the reference category of assistant medical officers or clinical officers. For glove use, nurses and midwives (10·06 [6·68–15·13]) and nursing and medical assistants (5·93 [4·05–8·71]) also significantly outperformed the reference category. Laboratory

technicians performed significantly better in glove use (11.95 [8.98–15.89]), but significantly worse in hand hygiene (0.27 [0.17–0.43]) and waste management (0.25 [0.14–0.44]) than the reference category. Health worker age was negatively associated with correct glove use and female health workers were more likely to comply with hand hygiene.

INTERPRETATION: Health worker infection prevention and control compliance, particularly for hand hygiene and disinfection, was inadequate in these outpatient settings. Improvements in provision of supplies and health worker behaviors are urgently needed in the face of the current pandemic.

Keywords: infection prevention and control, compliance, COVID-19, Tanzania

54. Lockdown measures in response to COVID-19 in nine sub-Saharan African countries

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ABSTRACT

Lockdown measures have been introduced worldwide to contain the transmission of COVID-19. However, the term 'lockdown' is not well-defined. Indeed, WHO's reference to 'so-called lockdown measures' indicates the absence of a clear and universally accepted definition of the term 'lockdown'. We propose a definition of 'lockdown' based on a two-by-two matrix that categorizes different communicable disease measures based on whether they are compulsory or voluntary; and whether they are targeted at identifiable individuals or facilities, or whether they are applied indiscriminately to a general population or area. Using this definition, we describe the design, timing and implementation of lockdown measures in nine countries in sub-Saharan Africa: Ghana, Nigeria, South Africa, Sierra Leone, Sudan, Tanzania, Uganda, Zambia and Zimbabwe. While there were some commonalities in the implementation of lockdown across these countries, a more notable finding was the variation in the design, timing and implementation of lockdown measures. We also found that the number of reported cases is heavily dependent on the number of tests carried out, and that testing rates ranged from 2031 to 63 928 per million populations up until 7 September 2020. The reported number of COVID-19 deaths per million populations also varies (0.4 to 250 up until 7 September 2020), but is generally low when compared with countries in Europe and North America. While lockdown measures may have helped inhibit community transmission, the pattern and nature of the epidemic remains unclear. However, there are signs of lockdown harming health by affecting the functioning of the health system and causing social and economic disruption.

Keywords: Lockdown, COVID-19, sub-Saharan Africa

55. Why lockdown? Why national unity? Why global solidarity? Simplified arithmetic tools for decision-makers, health professionals, journalists and the general public to explore containment options for the 2019 novel coronavirus

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ABSTRACT

As every country in the world struggles with the ongoing COVID-19 pandemic, it is essential that as many people as possible understand the epidemic containment, elimination and exclusion strategies required to tackle it. Simplified arithmetic models of COVID-19 transmission, control and elimination are presented in user-friendly Shiny and Excel formats that allow non-specialists to explore, query, critique and understand the containment decisions facing their country and the

world at large. Although the predictive model is broadly applicable, the simulations presented are based on parameter values representative of the United Republic of Tanzania, which is still early enough in its epidemic cycle and response to avert a national catastrophe. The predictions of these models illustrate (1) why ambitious lock-down interventions to crush the curve represent the only realistic way for individual countries to contain their national-level epidemics before they turn into outright catastrophes, (2) why these need to be implemented so early, so stringently and for such extended periods, (3) why high prevalence of other pathogens causing similar symptoms to mild COVID-19 precludes the use of contact tracing as a substitute for lock down interventions to contain and eliminate epidemics, (4) why partial containment strategies intended to merely flatten the curve, by maintaining epidemics at manageably low levels, are grossly unrealistic, and (5) why local elimination may only be sustained after lock down ends if imported cases are comprehensively excluded, so international co-operation to conditionally re-open trade and travel between countries certified as free of COVID-19 represents the best strategy for motivating progress towards pandemic eradication at global level. The three sequential goals that every country needs to emphatically embrace are containing, eliminate and exclude. As recently emphasized by the World Health Organization, success will require widespread genuine national unity and unprecedented global solidarity.

Keywords: Coronavirus; COVID-19, SARS2, Severe acute respiratory syndrome coronavirus 2, SARS-CoV-2, Model, Epidemiology, Outbreak, Zoonosis, Emerging infection

56. The Pandemic and the Economy of Africa: Conflicting Strategies between Tanzania and Ghana

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ABSTRACT

While the number of COVID-19 cases and deaths continues to rise all over the world, the numbers in Africa are not as high as predicted. With the exception of South Africa and Egypt, other countries in the continent seem to be faring well. There are still conflicting reasons as to how Africa has coped well in the face of the pandemic. While some countries, like Ghana, introduced lockdown measures, others, like Tanzania, dismissed the idea of a lockdown. Still, both countries have relatively less confirmed deaths. This article explores how messages conveyed by the Tanzanian and Ghanaian governments have played a role in dealing with the pandemic and the economic impact they face. We argue that the government messages did play a role in the registered confirmed cases. Tanzania, for instance, stopped registering cases and deaths after the president expressed distrust in the cases that were being announced, worried about what it could do to the economy. In Ghana, while the president took a different approach, his messages of hope and care prompted people to be more cautious, worrying about the economy later.

Keywords: Africa, African Economy, COVID-19, Ghana, Tanzania, Government Strategies

57. Community engagement in COVID-19 prevention: experiences from Kilimanjaro region, Northern

Tanzania

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ABSTRACT

Prevention of exposure to the COVID-19 virus in the general population is an essential strategy to slow community transmission. This paper shares the experiences and challenges of community engagement in COVID-19 prevention in the Kilimanjaro region, Northern Tanzania implemented by our team from the Institute of Public Health (IPH), Kilimanjaro Christian Medical University College (KCMUCo) in collaboration with the COVID-19 response team in the Moshi Municipality. We conducted an education session with the COVID-19 response team and together brainstormed transmission hotspots and which interventions would be most feasible in their settings. The first hotspot identified was crowded local market spaces. Suggested interventions included targeted and mass public health education through the engagement of market opinion leaders, public announcements, and radio shows. We conducted participatory rural appraisal techniques to enable market vendors and clients to visualize two-meter distances and provided a prototype hand-washing facility that was foot operated. We found mass public health educational campaigns essential to inform and update the public about COVID-19 pandemic and to address rumors and misinformation, which hampers compliance with public health interventions. Coordinated efforts among stakeholders in the country are necessary to develop context-specific prevention and case management strategies following the national and international guidelines. Local ownership of recommended interventions is necessary to ensure compliance.

Keywords: COVID-19, community engagement, community response, public health, experiences, Kilimanjaro, Tanzania

58. The changing trend of teleconsultations during COVID-19 era at a tertiary facility in Tanzania

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ABSTRACT

INTRODUCTION: the current COVID-19 pandemic has occasioned the increased adoption of telemedicine. This study reports the uptake and trend of a new teleconsultation service in a Tanzanian hospital.

METHODS: this is a retrospective observational study that profiled requests for teleconsultations and uptake of the service between April 1, 2020, and June 30, 2020.

RESULTS: two hundred and eighteen telephone inquiries were received over the 3 months. One hundred and sixteen (53.2%) individuals followed through with the teleconsultations. Pediatric (38.8%) and Internal medicine (32.8%) were the subspecialties with the highest number of teleconsultations. In a frame of 3 months, teleconsultation uptake was highest in May and lowest in June.

CONCLUSION: there was a steady rise and a rapid fall in requests and uptake of teleconsultation services over the period under evaluation. Lack of insurance coverage for teleconsultations was a significant barrier. We propose a re-education and reiteration of the benefits of telemedicine to all stakeholders. This is important for the current era and beyond.

Keywords: COVID-19, teleconsultation, telemedicine, health services, Tanzania

59. Bacteria Filtration Efficiency of Different Face Masks Worn during COVID-19 Pandemic in North-Eastern Tanzania: An in Vitro Study

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ABSTRACT

Increased demand for wearing face masks, lack of surgical masks and N95 respirators during the coronavirus pandemic created alternative needs for cloth masks. Therefore, to determine filtration efficacy, reusability and duration of wearing new and hand washed cloth masks, the bacteria filtration efficacy was tested using *Staphylococcus aureus* and *Escherichia coli*. Cotton cloth masks; single layer without pleats and with pleats, double layer with canvas filter in the middle, double layer with stiff filter in the middle, double layer with pleats on both sides and locally made and imported surgical masks and N95 respirators were used. Bacterial suspension was sprayed over outer surface and swabbed from inner surface at 0hrs, 4thhr, 8thhr and 12th hr. Similar procedure was performed to hand washed and ironed cotton cloth masks. After 24 hours of incubation, single layer without pleats and with pleats had no filtration efficacy (0-100%). Double layer with stiff filter in the middle and double layer with pleats on both sides had higher filtration efficacy (99.96-100%), this filtration efficacy remained up to three occasions of hand washing with soap and water, conferring protection up to 12hours. Filtration efficacy of surgical masks made locally, imported and N95 respirators were 90-100%, 99.99-100%, and 99.99-100% respectively.

Keywords: SARS-CoV-2; COVID-19; face masks; filtration efficiency; Tanzania

60. Fruit bats in flight: a look into the movements of the ecologically important *Eidolon helvum* in Tanzania

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ABSTRACT

BACKGROUND: Many ecologically important plants are pollinated or have their seeds dispersed by fruit bats, including the widely distributed African straw-colored fruit bats (*Eidolon helvum*). Their ability to fly long distances makes them essential for connecting plant populations across fragmented landscapes. While bats have been implicated as a reservoir of infectious diseases, their role in disease transmission to humans is not well understood. In this pilot study, we tracked *E. helvum* to shed light on their movement patterns in Tanzania and possible contact with other species.

METHODS: Tracking devices were deployed on 25 bats captured in the Morogoro Municipal and Kilombero District area near the Udzungwa Mountains of Tanzania. Nightly flight patterns, areas corresponding to foraging bouts and feeding roosts, and new day roosts were determined from bat movement data and characterized according to their proximity to urban built-up and protected areas. Sites for additional environmental surveillance using camera traps were identified via tracking data to determine species coming in contact with fruits discarded by bats.

RESULTS: Tracking data revealed variability between individual bat movements and a fidelity to foraging areas. Bats were tracked from one to six nights, with a mean cumulative nightly flight distance of 26.14 km (min: 0.33, max: 97.57) based on data from high-resolution GPS tags. While the majority of their foraging locations were in or near urban areas, bats also foraged in protected areas, of which the Udzungwa Mountains National Park was the most frequented. Camera traps in fruit orchards frequented by tracked bats showed the presence of multiple species of wildlife, with vervet monkeys (*Chlorocebus pygerythrus*) observed as directly handling and eating fruit discarded by bats.

CONCLUSIONS: Because we observed multiple interactions of animals with fruits discarded by bats, specifically with vervet monkeys, the possibility of disease spillover risk exists via this indirect pathway. With flight distances of up to 97 km, however, the role of *E. helvum* in the seed dispersal of plants across both protected and urban built-up areas in Tanzania may be even more important, especially by helping connect increasingly fragmented landscapes during this Anthropocene epoch.

Keywords: bats, Tanzania, virus

61. COVID-19 Awakening: Preparedness, Readiness and Response during the pandemic

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ABSTRACT

At the end of December 2019, the China public health authorities were informed on cases of unusual pneumonia detected in Wuhan City, mainland China. The causative agent was later identified to be a novel coronavirus (2019-nCoV) currently referred to as the severe acute

respiratory syndrome coronavirus 2 (SARS CoV-2). The World Health Organization declared the disease a public health emergency of international concern on 30th January 2020 and named it Coronavirus disease 2019 (COVID-19) on 11th February 2020. By 20th April 2020, over 2.4 million cases of COVID-19 had been reported from 210 countries and territories worldwide. The rate at which COVID-19 spreads and the fact that asymptomatic individuals can transmit the disease has risen concerns on how to control the pandemic in resource-constrained countries. We conducted a review of literatures and summarized the key lessons to inform policy and decision makers on strategies necessary for an effective response during the pandemic. We recommend comprehensive implementation of the proposed approaches that encompass robust containment strategies and flexible transition to scaling up mitigation strategies.

Keywords: novel coronavirus, severe acute respiratory syndrome coronavirus 2, SARS CoV-2, 2019-nCoV

62. An Assessment of the Impact of COVID-19 Pandemic in the Tourism Sector in Tanzania

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ABSTRACT

The aim of this study is to assess the impacts caused by COVID-19 in the tourism sector in Tanzania. Two major sources of data which was collected between March and May 2020 was social media and literature. COVID-19 led to lack of international visitors which directly affected the level of tourism activity and in some cases closure of businesses in the sector. Loss of business forced establishments to lay off part of its workforce and those who could be retained had to accept salary and wage cuts. Similarly, public institutions experienced significant reduction in tourism revenue. One of the major effects of this was a loss of their capacity to invest in product development, the initiative which had gained momentum in 2019. With limited spending power, future travellers are likely to be highly cost-sensitive, meaning that, high-cost destinations, such as long-haul destinations in Sub Sahara, shall be mostly affected. Despite the negative impacts, COVID-19 has triggered positive changes in destinations. With the shrinking size of inbound markets, industry operators have developed an unprecedented interest in domestic markets. On the other hand, the pandemic has helped players from public and private sectors to commit towards a common goal.

Keywords: COVID-19 Pandemic, Tourism, Impact, Tanzania

63. Socio-economic effects of COVID-19 pandemic on the performance of co-operative societies in Tanzania

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Journal of Co-operative and Business Studies (JCBS) 2020; 5 (2) ISSN: (online) 2714-2043, (print) 0856-9037 29 [SOCIO-ECONOMIC-EFFECTS-OF-COVID-19-PANDEMIC-ON-THE-PERFORMANCE-OF-CO-OPERATIVE-SOCIETIES-IN-TANZANIA.pdf](https://www.researchgate.net/publication/354111111) (researchgate.net)

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ABSTRACT

An unhealthy society shaded with fear can suffocate production, consumption, recreation, travel and overall well-being. This study examined the emerged socio-economic effects of the COVID-19 pandemic on the performance of co-operative societies in Tanzania. The study was guided by the Epidemiologic Transition Theory and the Resource Dependence Theory. Qualitative approaches were used in describing the emerged socio-economic effects of COVID-19 pandemic on the performance of the co-operative societies. Primary data were collected using telephone interviews as guided by pre-tested interview guide. Secondary data were obtained from published scholarly articles, non-scholarly articles and grey literature where a Systematic Literature Synthesis (SLS) was conducted to draw data from published articles. The findings indicated that the social interaction pattern was affected, the social distancing jeopardised the practice of democracy through Annual General Meetings (AGM), sluggish transportation of agricultural produces, limited loan recovery and increasing non-performing loans, decrease in members' savings and membership withdrawals. The study concludes that COVID-19 had tremendous short- and long-term socio-economic effects in the performance of cooperative societies. It is recommended that there is a need for the establishment of a Co-operative COVID-19 Response Committee (CCRC), the need to implement and promote an Integrated Co-operative Model (ICM) and enhancing the use of Information and Communication technology (ICT). Keywords: Corona Virus, COVID-19 Pandemic, Co-operatives societies and Socio-economic effects

Keywords: COVID-19, pandemic, Tanzania

64. Prevalence of pneumonia and its associated factors among under-five children in East Africa: a systematic review and meta-analysis.

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ABSTRACT

BACKGROUND: Pneumonia is defined as an acute inflammation of the Lungs' parenchymal structure. It is a major public health problem and the leading cause of morbidity and mortality in under-five children especially in developing countries. In 2015, it was estimated that about 102

million cases of pneumonia occurred in under-five children, of which 0.7 million were end up with death. Different primary studies in Eastern Africa showed the burden of pneumonia. However, inconsistency among those studies was seen and no review has been conducted to report the amalgamated magnitude and associated factors. Therefore, this review aimed to estimate the national prevalence and associated factors of pneumonia in Eastern Africa.

METHODS: Using PRISMA guideline, we systematically reviewed and meta-analyzed studies that examined the prevalence and associated factors of pneumonia from PubMed, Cochrane library, and Google Scholar. Heterogeneity across the studies was evaluated using the Q and the I² test. A weighted inverse variance random-effects model was applied to estimate the national prevalence and the effect size of associated factors. The subgroup analysis was conducted by country, study design, and year of publication. A funnel plot and Egger's regression test were used to see publication bias. Sensitivity analysis was also done to identify the impact of studies.

RESULT: A total of 34 studies with 87, 984 participants were used for analysis. The pooled prevalence of pneumonia in East Africa was 34% (95% CI; 23.80–44.21). Use of wood as fuel source (AOR = 1.53; 95% CI:1.30–1.77; I² = 0.0%; P = 0.465), cook food in living room (AOR = 1.47; 95% CI:1.16–1.79; I² = 0.0%; P = 0.58), caring of a child on mother during cooking (AOR = 3.26; 95% CI:1.80–4.72; I² = 22.5%; P = 0.26), Being unvaccinated (AOR = 2.41; 95% CI:2.00–2.81; I² = 51.4%; P = 0.055), Child history of Acute Respiratory Tract Infection (ARTI) (AOR = 2.62; 95% CI:1.68–3.56; I² = 11.7%; P = 0.337) were identified factors of pneumonia.

CONCLUSION: The prevalence of pneumonia in Eastern Africa remains high. This review will help policy-makers and program officers to design pneumonia preventive interventions.

Keywords: Pneumonia, Eastern-Africa, Under five children, Indicator Cluster Surveys (MICS) Child Health/ Pneumonia.2017

65. Inappropriate treatment of community-acquired pneumonia among children under five years of age in Tanzania

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ABSTRACT

OBJECTIVE: To describe the treatment of community-acquired pneumonia (CAP) in children under five years in Tanzania.

METHODS: Between January and December 2017, children aged 2–59 months with chest radiography confirmed CAP were enrolled. The parents were interviewed to collect information on the patients and home-based medication. Clinical information was derived from the patient files. Nasopharyngeal swab and blood samples were collected for isolation of the causative pathogens. Swab samples were analysed by quantitative PCR whereas blood samples were tested using BacT/Alert 3D.

RESULTS: Overall, 109 children with CAP were included in this analysis. Provision of care to most children was delayed (median = 4.6 days). A quarter (26.6%) were given unprescribed/leftover antibiotics at home. Only one child had positive bacterial culture. Referrals were associated with nasopharyngeal carriage of *Streptococcus pneumoniae* ($p = 0.003$) and *Haemophilus influenzae* ($p = 0.004$). Of all admitted children, more than a quarter ($n = 29$) did not need to be hospitalised and inappropriately received injectable instead of oral antibiotics.

CONCLUSION: We found high rates of home treatment, particularly with antibiotics. Appropriate health care was delayed for most children because of home treatment. Efforts are needed at the community level to improve awareness of antimicrobial resistance.

Keywords: Home treatment, Community-acquired pneumonia, Children under five years, Delays Unnecessary hospitalisation

66. Prevalence of gram negative bacteria causing community acquired pneumonia among adults in Mwanza City, Tanzania

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ABSTRACT

BACKGROUND: Community acquired pneumonia (CAP) in adults is still a common and serious illness in the sub-Saharan Africa. Identification of the pathogens is crucial in the management of CAP. This study was done to determine the common bacterial pathogens, treatment outcomes and associated factors for microbiological confirmed CAP among adults attending the Bugando Medical Centre and Sekou Toure hospital in the city of Mwanza, Tanzania.

METHODS: This was a hospital based cross sectional study involving patients with community acquired pneumonia attending Bugando Medical Centre and Sekou Toure regional Hospital. Demographic and other data were collected using standardized data collection tool. Sputum culture was done followed by identification of the isolates and antibiotics susceptibility testing.

RESULTS: A total of 353 patients were enrolled in the study. Out of 353 sputum samples, 265(75%) were of good quality. Of 353 non-repetitive sputum cultures, 72/353 (20.4, 95% CI:

16.2-24.6) were positive for the bacterial pathogens with five patients having more than one pathogen. Good quality sputa had significantly higher yield of pathogenic bacteria than poor quality sputa (26.1% vs.3.4%, $P = 0.001$). The majority 64 (83.1%) of the isolates were gram negative bacteria. Common bacteria isolated were *Klebsiella pneumoniae* 23/77(29.9%), *Streptococcus pyogenes* 10/77 (13.0%), *Pseudomonas aeruginosa* 9/77 (11.7%) and *Escherichia coli* 7/77 (9.1%). Of 23 *K. pneumoniae* isolates, 20/23 (87.0%) were resistant to ceftriaxone. Resistance to ceftriaxone was found to be associated with prolongation of CAP symptoms ($p = 0.009$).

CONCLUSION: Gram negative bacteria resistant to ampicillin, amoxicillin/clavulanic acid and ceftriaxone were most frequently isolated bacteria among adults' patients with CAP attending

BMC and Sekou Toure hospital. Routine sputum culture should be performed to guide appropriate treatment of CAP among adults in developing countries.

Keywords: Community acquired pneumonia, Tanzania

67. Predictors and outcome of first line treatment failure among under-five children with community acquired severe pneumonia at Bugando Medical Centre, Mwanza, Tanzania: A prospective cohort study

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ABSTRACT

BACKGROUND: Despite recent advances in management and preventive strategies, high rates of first line antibiotics treatment failure and case fatality for Severe Community Acquired Pneumonia (SCAP) continue to occur in children in low and middle-income countries. This study aimed to identify the predictors and outcome of first line antibiotics treatment failure among children under-five years of age with SCAP admitted at Bugando Medical Centre (BMC) in Mwanza, Tanzania.

METHODS: The study involved under-five children admitted with SCAP, treated with first line antibiotics as recommended by WHO. Patients with treatment failure at 48 hours were shifted to second line of antibiotics treatment and followed up for 7 days. Generalized linear model was used to determine predictors of first line antibiotics treatment failure for SCAP.

RESULTS: A total of 250 children with SCAP with a median age of 18 [IQR 9-36] months were enrolled, 8.4% had HIV infection and 28% had acute malnutrition. The percentage of first line antibiotics treatment failure for the children with SCAP was 50.4%. Predictors of first line treatment failure were; presentation with convulsion (RR 1.55; 95% CI [1.11-2.16]; p-value 0.009), central cyanosis (RR 1.55; 95% CI [1.16-2.07]; p-value 0.003), low oxygen saturation (RR 1.28; 95% CI [1.01-1.62]; p-value 0.04), abnormal chest X-ray (RR 1.71; 95% CI [1.28-2.29]; p-value <0.001), HIV infection (RR 1.80; 95% CI [1.42-2.27]; p-value 0.001), moderate acute malnutrition (RR 1.48; 95% CI [1.04-2.12]; p-value = 0.030) and severe acute malnutrition (RR 2.02; 95% CI [1.56-2.61]; p-value <0.001). Mortality in children who failed first line treatment was 4.8%.

CONCLUSION: Half of the children with SCAP at this tertiary center had first line antibiotics treatment failure. HIV infection, acute malnutrition, low oxygen saturation, convulsions, central cyanosis, and abnormal chest X-ray were independently predictive of first line treatment failure. We recommend consideration of second line treatment and clinical trials for patients with SCAP to reduce associated morbidity and mortality.

Keywords: Community acquired pneumonia, Tanzania

68. Factors That Negatively Affect the Prognosis of Pediatric Community-Acquired Pneumonia in District Hospital in Tanzania

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ABSTRACT

Community-acquired pneumonia (CAP) is still the most important cause of death in countries with scarce resources. All children (33 months \pm 35 DS) discharged from the Pediatric Unit of Itigi Hospital, Tanzania, with a diagnosis of CAP from August 2014 to April 2015 were enrolled. Clinical data were gathered. Dried blood spot (DBS) samples for quantitative real-time polymerase chain reaction (PCR) for bacterial detection were collected in all 100 children included. Twenty-four percent of patients were identified with severe CAP and 11% died. Surprisingly, 54% of patients were admitted with a wrong diagnosis, which increased complications, the need for antibiotics and chest X-rays, and the length of hospitalization. Comorbidity, found in 32% of children, significantly increased severity, complications, deaths, need for chest X-rays, and oxygen therapy. Malnourished children (29%) required more antibiotics. Microbiologically, Streptococcus

pneumonia (*S. p.*), *Haemophilus influenzae* type b (Hib) and *Staphylococcus aureus* (*S. a.*) were the bacteria more frequently isolated. Seventy-five percent of patients had mono-infection. Etiology was not correlated with severity, complications, deaths, oxygen demand, or duration of hospitalization. Our study highlights that difficult diagnoses and comorbidities negatively affect clinical evolution. *S. p.* and Hib still play a large role; thus, implementation of current vaccine strategies is needed. DBS is a simple and efficient diagnostic method for bacterial identification in countries with scarce resources.

Keywords: antibiotic therapy; community-acquired pneumonia; developing countries; molecular diagnostic; prevention; vaccines.

69. Viral-bacterial (co-)occurrence in the upper airways and the risk of childhood pneumonia in resource-limited settings

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ABSTRACT

OBJECTIVE: To examine the association between bacterial-viral co-occurrence in the nasopharynx and the risk of community acquired pneumonia (CAP) in young children living in resource-limited settings.

METHODS: A case-control study was conducted between January and December 2017 in Moshi, Tanzania. Children 2-59 months with CAP and healthy controls were enrolled. RSV and Influenza A/B were detected with a standardized polymerase chain reaction (PCR) method, and a simplified real-time quantitative PCR method, without sample pre-processing, was developed to detect bacterial pathogens in nasopharyngeal samples.

RESULTS: A total of 109 CAP patients and 324 healthy controls were enrolled. Co-detection of *H. influenzae* and *S. pneumoniae* in nasopharyngeal swabs was linked with higher odds of CAP (aOR=3.2, 95% CI=1.1-9.5). The majority of the *H. influenzae* isolated in cases and controls (95.8%) were non-typeable. Of the viruses examined, respiratory syncytial virus (RSV) was most

common (n = 31, 7.2%) in cases and controls. Children with RSV had 8.4 times higher odds to develop pneumonia than healthy children (aOR=8.4, 95%CI= 3.2 - 22.1).

CONCLUSIONS: Co-occurrence of H. influenzae and S. pneumoniae in the nasopharynx was strongly associated with CAP. The high prevalence of non-typeable H. influenzae might be a sign of replacement as a consequence of Haemophilus influenzae type b vaccination.

Keywords: Bacterial and viral colonization; Children under five years of age; Community-acquired pneumonia; Tanzania.

70. Invasive liver abscess syndrome caused by *Klebsiella pneumoniae*: first Tanzanian experience

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ABSTRACT

Over the past 20 years there has been growing awareness of community-acquired primary liver abscess caused by strains of *Klebsiella pneumoniae* (*K. pneumoniae*) especially in patients of Asian descent, a minority of which are characterized by metastatic spread. A common and frequent destructive complication is endophthalmitis as well as the involvement of the central nervous system (CNS), causing suppurative meningitis or brain abscess. Here we report a case of invasive liver abscess caused by *K. pneumoniae* in an Asian patient who presented to our hospital in Tanzania with bilateral lower limb swelling for 6 weeks with acute onset of difficulty in breathing.

Keywords: Hepatic abscess; *Klebsiella pneumoniae*; invasive syndrome.

71. The cost of routine immunization outreach in the context of COVID-19: estimates from Tanzania and Indonesia

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<https://thinkwell.global/wp-content/uploads/2020/07/Cost-of-outreach-vaccination-in-the-context-of-COVID-19-20-July-2020.pdf>

ABSTRACT

This analysis assesses changes in the cost of delivering immunization through outreach in Tanzania and Indonesia, where detailed costing studies of outreach services have recently been conducted. The COVID-19 pandemic is disrupting immunization services due the additional burden and constraints it places on the health system, and reluctance in communities to visit health facilities. Reduced attendance during immunization sessions at facilities and the closing of schools requires countries to innovate to keep coverage high. WHO guidance advises countries to explore innovative methods for vaccine delivery to optimize service delivery while minimizing the risks of COVID-19 transmission. Countries may increase the frequency with which outreach is conducted to compensate for reductions in coverage of other delivery strategies and keep session sizes small. On the other hand, they may limit outreach to reduce community touchpoints. In addition, providing health workers with personal protective equipment (PPE) for immunization activities, ensuring physical distancing and screening, and setting up hand washing stations and offering hand sanitizer at session sites all impact the cost of delivering immunization.

The results of this analysis show that the cost of delivering immunization through outreach could increase by 20-129% depending on the way outreach strategies will be adapted. Based on data from Tanzania and Indonesia, adding hand washing stations and hand sanitizer at outreach sites could increase the delivery cost per dose by 11-14% or if health workers would be provided with PPE (masks, gloves and goggles) as well, the increase could be 45-61%. An additional crowd controller during outreach sessions to manage physical distancing and screening may increase the incremental financial cost if they would receive per diems (9%) and adding two staff and infrared thermometers could increase the cost per dose by up to 42%. If facility-based coverage drops by 50%, the cost of increasing outreach to compensate for this could add up to 11% per dose. Cost savings from halving the frequency of outreach are likely limited (-2 to -16%), while doubling the frequency to reduce the size of outreach sessions can increase the cost per dose by 18-40%.

Keywords: COVID-19, immunization, Tanzania, Indonesia

72. High rate of antimicrobial resistance and multiple mutations in the dihydrofolate reductase gene among *Streptococcus pneumoniae* isolated from HIV-infected adults in a community setting in Tanzania

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ABSTRACT

OBJECTIVES: The aim of this study was to characterize molecular mechanisms of resistance to trimethoprim and other antibiotics in *Streptococcus pneumoniae* isolates from HIV-infected adults in Dar es Salaam, Tanzania.

METHODS: A total of 1877 nasopharyngeal swabs were collected and screened for pneumococcal colonization from 537 newly diagnosed individuals with HIV at four clinic visits during a 1-year follow-up from 2017–2018 as part of the randomized clinical trial CoTrimResist (ClinicalTrials.gov ID: NCT03087890).

RESULTS: A total of 76 pneumococcal isolates were obtained. Of the 70 isolates that could be serotyped, 42 (60.0%) were vaccine serotypes included in pneumococcal conjugate vaccine 23 (PCV23). The majority of isolates (73.7%; 56/76) were non-susceptible to penicillin (MICs of 0.06–2 µg/mL). Isolates were frequently resistant to co-trimoxazole (trimethoprim/sulfamethoxazole) (71.1%) but less so to azithromycin (22.4%), erythromycin (21.1%), chloramphenicol (18.4%), tetracycline (14.5%), clindamycin (10.5%) and levofloxacin (0%). Moreover, 26.3% were multidrug-resistant (resistant to ≥3 antibiotic classes). Vaccine-type pneumococci were resistant to more classes of antibiotics, were more frequently resistant to erythromycin, azithromycin, clindamycin and tetracycline, and had higher MICs to penicillin (median, 0.19 µg/mL; range, 0.002–1.5 µg/mL) compared with non-vaccine serotypes (median, 0.125 µg/mL; range, 0.012–0.25 µg/mL) ($P = 0.003$). Co-trimoxazole-resistant isolates carried from 1 to 11 different mutations in the dihydrofolate reductase (DHFR) gene, most commonly Ile100Leu (100%), Glu20Asp (91.8%), Glu94Asp (61.2%), Leu135Phe (57.1%), His26Tyr (53.1%), Asp92Ala (53.1%) and His120Gln (53.1%).

CONCLUSION: *Streptococcus pneumoniae* isolated from HIV-diagnosed patients were frequently non-susceptible to penicillin and co-trimoxazole. Most isolates carried multiple mutations in DHFR.

Keywords: Antimicrobial resistance, *Streptococcus pneumoniae*, HIV, Tanzania, Dihydrofolate reductase

73. Safety and Immunogenicity of a 2-Dose Heterologous Vaccination Regimen with Ad26.ZEBOV and MVA-BN-Filo Ebola Vaccines: 12-Month Data from a Phase 1 Randomized Clinical Trial in Uganda and Tanzania

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ABSTRACT

BACKGROUND: Ebola vaccine development was accelerated in response to the 2014 Ebola virus infection outbreak. This phase 1 study (VAC52150EBL1004) assessed safety, tolerability, and immunogenicity of heterologous 2-dose Ad26.ZEBOV, MVA-BN-Filo vaccination regimens in the Lake Victoria Basin of Tanzania and Uganda in mid-level altitude, malaria-endemic settings.

METHODS: Healthy volunteers aged 18–50 years from Tanzania (n = 25) and Uganda (n = 47) were randomized to receive placebo or active vaccination with Ad26.ZEBOV or MVA-BN-Filo (first vaccination), followed by MVA-BN-Filo or Ad26.ZEBOV (second vaccination) dose 2, respectively, with intervals of 28 or 56 days.

RESULTS: Seventy-two adults were randomized to receive vaccine (n = 60) or placebo (n = 12). No vaccine-related serious adverse events were reported. The most frequent solicited local and systemic adverse events were injection site pain (frequency, 70%, 66%, and 42% per dose for MVA-BN-Filo, Ad26.ZEBOV, and placebo, respectively) and headache (57%, 56%, and 46%, respectively). Adverse event patterns were similar among regimens. Twenty-one days after dose 2, 100% of volunteers demonstrated binding antibody responses against Ebola virus glycoprotein, and 87%–100% demonstrated neutralizing antibody responses. Ad26.ZEBOV dose 1 vaccination induced more-robust initial binding antibody and cellular responses than MVA-BN-Filo dose 1 vaccination.

CONCLUSIONS: Heterologous 2-dose vaccination with Ad26.ZEBOV and MVA-BN-Filo against Ebola virus is well tolerated and immunogenic in healthy volunteers.

Keywords: Ebola vaccine, heterologous 2-dose, Ad26.ZEBOV, MVA-BN-Filo, safety and immunogenicity

74. The impact of COVID-19 on gender aspects of the informal sector in Tanzania

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ABSTRACT

Global statistics show that more than 60 per cent of the world's employed population earns their informal economy livelihood. In Africa, for instance, it is recorded that every eight out of ten people work in the informal sector. The informal economy segment in Sub-Saharan Africa (SSA) remains one of the largest in the world, even though this share has been very gradually declining, as seems to be the case globally. In Tanzania, it makes 75 per cent of total employment and over 80 per cent of total GDP. Evidence shows that most people enter the informal economy not by choice but due to a lack of opportunities in the formal economy and the absence of other means of livelihood. Moreover, it is widely accepted that a large informal economy has adverse economic

effects at the macro and micro-levels. Such economic impact includes poor labour conditions, insufficient tax basis, inadequate coverage of social protection, lower earnings, higher gender gaps and a negative influence on macroeconomic growth. Moreover, some specific sectors are highly dominated by women and others by men. In SSA, women are concentrated in informal economy segments where productivity and earnings are low, hampered by inadequate access to capital, public services, social protection and infrastructure, and often face a skills deficit. There is a much more significant proportion of women in informal work areas such as production for own consumption, home-based and domestic work, where their invisibility reduces their capacity for collective bargaining and increases their exposure to exploitation. The types of informal work women do as market or street vendors, hawkers or homeworkers, expose them to risks to their physical safety and health. This policy brief focuses on examining the impact of COVID-19 on gender aspects of Tanzania's informal sector.

Keywords: COVID-19, Tanzania, pandemic, informal sector, gender, economic development

75. Patterns of viral pathogens causing upper respiratory tract infections among symptomatic children in Mwanza, Tanzania

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ABSTRACT

Upper-respiratory tract infections (URTI) are the leading causes of childhood morbidities. This study investigated etiologies and patterns of URTI among children in Mwanza, Tanzania. A cross-sectional study involving 339 children was conducted between October-2017 and February-2018. Children with features suggestive of URTI such as nasal congestion, dry cough, painful swallowing and nasal discharge with/without fever were enrolled. Pathogens were detected from nasopharyngeal and ear-swabs by multiplex-PCR and culture respectively. Full blood count and C-reactive protein analysis were also done. The median age was 16 (IQR: 8–34) months. Majority (82.3%) had fever and nasal-congestion (65.5%). Rhinitis (55.9%) was the commonest diagnosis followed by pharyngitis (19.5%). Viruses were isolated in 46% of children, the commonest being Rhinoviruses (23.9%). Nineteen percent of children had more than 2 viruses; Rhinovirus and Enterovirus being the commonest combination. The commonest bacteria isolated from ears were

Staphylococcus aureus and *Pseudomonas aeruginosa*. Children with viral pathogens had significantly right shift of lymphocytes (73%—sensitivity). Majority (257/339) of children were symptoms free on eighth day. Viruses are the commonest cause of URTI with Rhinitis being the common diagnosis. Rapid diagnostic assays for URTI pathogens are urgently needed in low-income countries to reduce unnecessary antibiotic prescriptions which is associated with antibiotic resistance.

76. Safety and Efficacy of C-reactive Protein–guided Antibiotic Use to Treat Acute Respiratory Infections in Tanzanian Children: A Planned Subgroup Analysis of a Randomized Controlled Non-inferiority Trial Evaluating a Novel Electronic Clinical Decision Algorithm (ePOCT)

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ABSTRACT

BACKGROUND: The safety and efficacy of using C-reactive protein (CRP) to decide on antibiotic prescription among febrile children at risk of pneumonia has not been tested.

METHODS: This was a randomized (1:1) controlled non-inferiority trial in 9 primary care centres in Tanzania (sub-study of the ePOCT trial evaluating a novel electronic decision algorithm). Children aged 2–59 months with fever and cough and without life-threatening conditions received an antibiotic based on a CRP-informed strategy (combination of CRP ≥ 80 mg/L plus age/temperature-corrected tachypnea and/or chest in-drawing) or current World Health Organization standard (respiratory rate ≥ 50 breaths/minute). The primary outcome was clinical failure by day (D) 7; the secondary outcomes were antibiotic prescription at D0, secondary hospitalization, or death by D30.

RESULTS: A total of 1726 children were included (intervention: 868, control: 858; 0.7% lost to follow-up). The proportion of clinical failure by D7 was 2.9% (25/865) in the intervention arm vs 4.8% (41/854) in the control arm (risk difference, -1.9% [95% confidence interval {CI}, -3.7% to

–.1%]; risk ratio [RR], 0.60 [95% CI, .37–.98]). Twenty of 865 (2.3%) children in the intervention arm vs 345 of 854 (40.4%) in the control arm received antibiotics at D0 (RR, 0.06 [95% CI, .04–.09]). There were fewer secondary hospitalizations and deaths in the CRP arm: 0.5% (4/865) vs 1.5% (13/854) (RR, 0.30 [95% CI, .10–.93]).

CONCLUSIONS: CRP testing using a cut-off of ≥ 80 mg/L, integrated into an electronic decision algorithm, was able to improve clinical outcome in children with respiratory infections while substantially reducing antibiotic prescription.

Keywords: C-reactive protein, respiratory infection, paediatrics, electronic decision support algorithm, integrated management of childhood illness

77. Prevalence and clinical significance of respiratory viruses and bacteria detected in tuberculosis patients compared to household contact controls in Tanzania: a cohort study

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ABSTRACT

OBJECTIVES: To describe the prevalence of respiratory pathogens in tuberculosis (TB) patients and in their household contact controls, and to determine the clinical significance of respiratory pathogens in TB patients.

METHODS: We studied 489 smear-positive adult TB patients and 305 household contact controls without TB with nasopharyngeal swab samples within an ongoing prospective cohort study in Dar es Salaam, Tanzania, between 2013 and 2015. We used multiplex real-time PCR to detect 16 respiratory viruses and seven bacterial pathogens from nasopharyngeal swabs.

RESULTS: The median age of the study participants was 33 years; 61% (484/794) were men, and 21% (168/794) were HIV-positive. TB patients had a higher prevalence of HIV (28.6%; 140/489) than controls (9.2%; 28/305). Overall prevalence of respiratory viral pathogens was

20.4% (160/794; 95%CI 17.7–23.3%) and of bacterial pathogens 38.2% (303/794; 95%CI 34.9–41.6%). TB patients and controls did not differ in the prevalence of respiratory viruses (Odds Ratio [OR] 1.00, 95%CI 0.71–1.44), but respiratory bacteria were less frequently detected in TB patients (OR 0.70, 95%CI 0.53–0.94). TB patients with both respiratory viruses and respiratory bacteria were likely to have more severe disease (adjusted OR [aOR] 1.6, 95%CI 1.1–2.4; p 0.011). TB patients with respiratory viruses tended to have more frequent lung cavitations (adjusted OR 1.6, 95%CI 0.93–2.7; p 0.089).

CONCLUSIONS: Respiratory viruses are common for both TB patients and household controls. TB patients may present with more severe TB disease, particularly when they are co-infected with both bacteria and viruses.

Keywords: Haemophilus influenza, Human rhinovirus, virus, Influenza, Respiratory bacteria, Respiratory viruses, Tanzania, Tuberculosis

78. Trends, patterns and causes of respiratory disease mortality among inpatients in Tanzania, 2006–2015

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ABSTRACT

OBJECTIVE: To determine the causes, patterns and trends of respiratory diseases-related deaths in hospitals of Tanzania 2006–2015.

METHODS: Retrospective study involving 39 hospitals. Medical records of patients who died in hospital were retrieved, reviewed and analyzed. Sources of data were hospital admission registers, death registers and International Classification of Diseases report forms. Information on demographic characteristics, date of death, the immediate underlying cause of death and co-morbid conditions was collected.

RESULTS: Of the 247 976 deaths reported during the 10-year period, respiratory diseases accounted for 12.92% (n = 32 042). The majority of the respiratory mortality was reported among males (55.9%). Overall median age at death was 31 years with an interquartile range (IQR) of 1–47. Median age at death was significantly higher among males (35 years) than females (28 years) (P < 0.0001). Most deaths (37.8%) occurred in eastern Tanzania. About one-third (31.3%) of all respiratory mortality was reported among under-five children, being among girls than boys (34.3% vs. 28.9%, $\chi^2 = 10.3$, P < 0.0001). Adolescent and young adult females (15–29 years) had higher age-standardized mortality rates per 100 000 due respiratory diseases than males. Pneumonia (n = 16 639; 51.9%) and pulmonary tuberculosis (n = 9687; 30.2%) accounted for the majority of

deaths due to respiratory diseases. Significantly more females (n = 7665; 54.5%) than males died from pneumonia (n = 8878; 49.8%; $\chi^2 = 8.5$, $P < 0.0001$). By contrast, significantly more males (n = 6024; 34%) than females (n = 3596; 26%; $\chi^2 = 15.5$, $P < 0.0001$) died of tuberculosis. The proportion of death due to tuberculosis declined from 32.8% in 2006–2010 to 7.9% in 2011–2015. However, there was a significant increase in the proportion of death due to pneumonia from 49.6% in 2006–2010 to 53.4% in 2011–2015. Co-morbid conditions contributed to 9.1% (2871/31 628) of all deaths due to respiratory diseases. The most common co-morbid condition was HIV which accounted for 1735 (60.4%) deaths and was more common among males (60.8%; n = 957) than among females (59.7%; n = 764).

CONCLUSIONS: Respiratory diseases account for a substantial proportion of all causes of hospital death in Tanzania. Pneumonia and tuberculosis contribute to more than three quarters of all deaths due to respiratory diseases. Since most major respiratory illnesses are avoidable, it is important to strengthen the capacity of the health delivery system in managing cases of respiratory diseases.

Keywords: respiratory diseases, inpatients, mortality, pattern, hospital, Tanzania

79. A Combined Syndromic Approach to Examine Viral, Bacterial, and Parasitic Agents among Febrile Patients: A Pilot Study in Kilombero, Tanzania

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ABSTRACT

The use of fever syndromic surveillance in sub-Saharan Africa is an effective approach to determine the prevalence of both malarial and nonmalarial infectious agents. We collected both blood and naso/oro-pharyngeal (NP/OP) swabs from consecutive consenting patients ≥ 1 year of age, with an axillary temperature $\geq 37.5^\circ\text{C}$, and symptom onset of ≤ 5 days. Specimens were analyzed using both acute febrile illness (AFI) and respiratory TaqMan array cards (Resp TAC) for multiagent detection of 56 different bloodstream and respiratory agents. In addition, we collected epidemiologic data to further characterize our patient population. We enrolled 205 febrile patients, including 70 children (1 < 15 years of age; 34%) and 135 adults (≥ 15 years of age; 66%). AFI TAC and Resp TAC were performed on 191 whole blood specimens and 115 NP/OP specimens, respectively. We detected nucleic acid for Plasmodium (57%), Leptospira (2%), and

dengue virus (1%) among blood specimens. In addition, we detected 17 different respiratory agents, most notably, *Haemophilus influenzae* (64%), *Streptococcus pneumoniae* (56%), *Moraxella catarrhalis* (39%), and respiratory syncytial virus (11%) among NP/OP specimens. Overall median cycle threshold was measured at 26.5. This study provides a proof-of-concept for the use of a multiagent diagnostic approach for exploratory research on febrile illness and underscores the utility of quantitative molecular diagnostics in complex epidemiologic settings of sub-Saharan Africa.

Keywords: *Haemophilus influenzae*, pneumonia, Tanzania

80. Adenovirus infection in savanna chimpanzees (*Pan troglodytes schweinfurthii*) in the Issa Valley, Tanzania

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ABSTRACT

Adenoviruses are a widespread cause of diverse human infections with recently confirmed zoonotic roots in African great apes. We focused on savanna-dwelling chimpanzees in the Issa Valley (Tanzania), which differ from those from forested sites in many aspects of behavior and ecology. PCR targeting the DNA polymerase gene detected AdV in 36.7% (69/188) of fecal samples. We detected five groups of strains belonging to the species Human mastadenovirus E and two distinct groups within the species Human mastadenovirus C based on partial hexon sequence. All detected AdVs from the Issa Valley are related to those from nearby Mahale and Gombe National Parks, suggesting chimpanzee movements and pathogen transmission.

Keywords: Adenovirus, Tanzania

81. Detection of novel astroviruses MLB1 and MLB2 in the sera of febrile Tanzanian children

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ABSTRACT

Recent outbreaks due to the Zika, Chikungunya, and Yellow fever viruses have provided an urgent incentive to better identify fevers' etiologies. Unbiased high-throughput screening has allowed the discovery of unexpected viral infections, such as those not previously considered to be human pathogens or strains that are too genetically divergent to be recognized by conventional targeted screening methods. These advances have also identified the importance of "commensal" organisms, including viruses, that may significantly impact health and disease. Next-generation sequencing (NGS) is one of the most powerful tools in this new wave of pathogen discovery, providing high-resolution nuances to human pathogenomic diversity. Using this approach in pediatric samples from an outpatient clinic in urban Tanzania, we describe the presence of the novel human astroviruses, (HAstV)-MLB1 and MLB2, in two patients with different clinical outcomes. Unbiased NGS was performed on 135 serum samples collected between December 2014 and February 2016. The samples were selected randomly from a cohort presenting with either "fever without a clinical focus" or "severe febrile disease requiring hospital referral". Participants in this study were malaria-negative by rapid diagnostic testing and were managed by electronic clinical algorithms. RNA and DNA libraries were prepared as previously described for analysis by NGS paired-end sequencing using the 100-bp protocol. The HiSeq 2500 and 4000 platforms (Illumina, San Diego, US) were used for RNA and DNA, respectively, generating an average of 96 million reads per sample. Raw data were analyzed using an updated version of the ezVIR pipeline. Novel HAstV were detected in two patients (raw data available here: [10.5281/zenodo.1094970](https://doi.org/10.5281/zenodo.1094970)), Case #1 (158 HAstV-MLB1 reads, genome coverage = 29.54%) and #2 (459 HAstV-MLB2 reads, genome coverage = 95.83%. Case #1: a 9-month-old male

presented with a 3-day history of fever (axillary temperature of 37.6 °C) and no other complaints or signs of focal infection. Malaria rapid diagnostic testing and blood cultures were negative; the urine dipstick was normal. The patient had no underlying co-morbidities reported and tested negative for HIV at inclusion. Additionally, his mother reported an HIV-negative result during routine prenatal screening. A diagnosis of “presumed viral infection of unknown etiology” was assigned. The patient did not receive any antimicrobials and was asymptomatic by day 3 of follow-up. NGS also detected a torque teno virus (TTV, 254 853 reads. HAstV-MLB1 presence was confirmed by real-time RT-PCR with a viral load estimated at 2700 RNA copies/mL per the MLB1 assay. Case #2: a 3.5-year-old male presented with a 5-day history of fever and cough. A past medical history of untreated HIV infection and chronic malnutrition were also documented. A temperature of 38.9 °C was measured at triage accompanied by tachypnea but with normal oxygen saturation (respiratory rate: 60 bpm, O₂Sat: 99%). Laboratory workup showed severe anemia (Hb 3.2 gm/dl), and HIV infection was confirmed by rapid test; however, no CD4 + T-cell counts were available. Malaria RDT and blood cultures were negative, and the urine dipstick was normal. C-reactive protein was measured at 80 mg/dL; lactate was 3.5 mmol/L. An initial diagnosis of “sepsis and severe anemia” was assigned, and the patient was immediately hospitalized. The hospital-based treatment included packed red blood cells and presumptive antibiotic treatment with penicillin, gentamicin, rifampicin, and ethambutol (based on clinically suspected tuberculosis). During hospitalization, the child developed progressive respiratory distress with hypoxemia and clinical signs of liver failure with ascites and jaundice. Penicillin/gentamicin was then changed to co-trimoxazole and steroids due to a suspected *Pneumocystis jirovecii* infection (no microbiological confirmation attempted). The patient died on the 8th day of hospitalization. No autopsy was performed. Subsequent NGS analysis on blood samples confirmed the presence of HIV-1 (27,044 reads), HHV-8 (2487 reads), adeno-associated virus (40 reads), and TTV (3,245,696 reads). HAstV-MLB2 was confirmed by real-time RT-PCR with a viral load estimated at 72,000 RNA copies/mL using the MLB2 and MLB2-3 assays. The high viral load may suggest a potential association between HAstV-MLB2 and the illness, especially without an alternative diagnosis and no clinical response to antibiotics. In conclusion, this study reports the first description (to our knowledge) of HAstV-MLB1 in a blood sample from a patient with transient uncomplicated febrile disease. It is also the first description a HAstV-MLB2/HIV co-infection. The high viral load and fatal outcome in the latter case supports the rationale to investigate the potential pathogenic role of novel HAstV in immunocompromised patients. Therefore, this study underscores that novel HAstV may be implicated in various clinical presentations, and implementing routine molecular assays should be considered in susceptible populations.

Keywords: novel astroviruses, children, Tanzania

82. A diagnostic and epidemiologic investigation of acute febrile illness (AFI) in Kilombero, Tanzania

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ABSTRACT

INTRODUCTION: In low-resource settings, empiric case management of febrile illness is routine as a result of limited access to laboratory diagnostics. The use of comprehensive fever syndromic surveillance, with enhanced clinical microbiology, advanced diagnostics and more robust epidemiologic investigation, could enable healthcare providers to offer a differential diagnosis of fever syndrome and more appropriate care and treatment.

METHODS: We conducted a year-long exploratory study of fever syndrome among patients ≥ 1 year of age, presenting to clinical settings with an axillary temperature of $\geq 37.5^{\circ}\text{C}$ and symptomatic onset of ≤ 5 days. Blood and naso-pharyngeal/oral-pharyngeal (NP/OP) specimens were collected and analysed, respectively, using AFI and respiratory TaqMan Array Cards (TAC) for multipathogen detection of 57 potential causative agents. Furthermore, we examined numerous epidemiologic correlates of febrile illness, and conducted demographic, clinical, and behavioral domain-specific multivariate regression to statistically establish associations with agent detection.

RESULTS: From 15 September 2014–13 September 2015, 1007 febrile patients were enrolled, and 997 contributed an epidemiologic survey, including: 14% ($n = 139$) $1 < 5$ yrs, 19% ($n = 186$) $5 - 14$ yrs, and 67% ($n = 672$) ≥ 15 yrs. AFI TAC and respiratory TAC were performed on 842 whole blood specimens and 385 NP/OP specimens, respectively. Of the 57 agents surveyed, Plasmodium was the most common agent detected. AFI TAC detected nucleic acid for one or more of seven microbial agents in 49% of AFI blood samples, including: Plasmodium (47%), Leptospira (3%), Bartonella (1%), Salmonella enterica (1%), Coxiella burnetii (1%), Rickettsia (1%), and West Nile virus (1%). Respiratory TAC detected nucleic acid for 24 different microbial agents, including 12 viruses and 12 bacteria. The most common agents detected among our surveyed population were: Haemophilus influenzae (67%), Streptococcus pneumoniae (55%), Moraxella catarrhalis (39%), Staphylococcus aureus (37%), Pseudomonas aeruginosa (36%), Human Rhinovirus (25%), influenza A (24%), Klebsiella pneumoniae (14%), Enterovirus (15%) and group A Streptococcus (12%). Our epidemiologic investigation demonstrated both age and symptomatic presentation to be associated with a number of detected agents, including, but not limited to, influenza A and Plasmodium. Linear regression of fully-adjusted mean cycle threshold (Ct) values for Plasmodium also identified statistically significant lower mean Ct values for older children (20.8), patients presenting with severe fever (21.1) and headache (21.5), as well as patients admitted for in-patient care and treatment (22.4).

CONCLUSIONS: This study is the first to employ two syndromic TaqMan Array Cards for the simultaneous survey of 57 different organisms to better characterize the type and prevalence of detected agents among febrile patients. Additionally, we provide an analysis of the association between adjusted mean Ct values for Plasmodium and key clinical and demographic variables,

which may further inform clinical decision-making based upon intensity of infection, as observed across endemic settings of sub-Saharan Africa.

Keywords: Human Rhinoviruses, Tanzania

83. Bacteremia caused by multidrug-resistant bacteria among hospitalized malnourished children in Mwanza, Tanzania: a cross sectional study

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ABSTRACT

BACKGROUND: Severe malnutrition has been known to increase susceptibility and severity of infections. Bacteremia in malnourished children has been found to increase morbidity and mortality especially if is due to multidrug resistant bacteria. Here, we report the prevalence of bacteremia among children under 5 years of age and the antibiotic susceptibility pattern of the isolates; the information that can be used by clinicians to guide on the empirical antibiotic treatment.

FINDINGS: A total of 402 malnourished children were investigated for bacteremia. The median age of enrolled children was 17 (IQR 12–31) months. Severe malnutrition was observed in 19.1% of malnourished under-fives. The point prevalence of bacteremia among malnourished children was 56/402 (13.9%; 95% CI 10.3–17.3). The prevalence of bacteremia was significantly higher among severely malnourished children than in children with moderate/mild malnutrition (18.0 vs. 10.7%, $P = 0.03$). Mortality was significantly associated with bacteremia among severely malnourished children (OR 2.77, 95% CI 1.02–6.98, $P = 0.02$). *Pseudomonas* spp. 20/56 (35.7%) were the most frequent isolates while *Staphylococcus aureus* and *Streptococcus pneumoniae* were isolated in 8/56 (14.2%) and 5/56 (8.9%) respectively. Rates of resistance for gram negative bacteria were; ampicillin (100%), amoxicillin/clavulanic acid (85.7%), gentamicin (23.8%), ceftriaxone (23.8%), ceftazidime (23.8%) meropenem (4.7%) and ciprofloxacin (2.4%). methicillin resistant *S. aureus* strains were confirmed in 4/8 (50%) of *S. aureus* isolates and 60% of *S. pneumoniae* isolates were resistant to 1 µg oxacillin.

CONCLUSION: Bacteremia due to multi drug resistant isolates is common among severely malnourished children under 5 years of age. There is a need to review empirical antibiotic treatment coupled with antibiotic stewardship to prevent mortality and morbidity of severely malnourished children under 5 years of age.

Keywords: *Streptococcus pneumoniae*

84. Prevalence of Group A Rotavirus in Piglets in a Peri-Urban Setting of Arusha, Tanzania

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ABSTRACT

AIMS: Rotavirus-associated enteritis is a major problem in livestock, notably in young piglets and calves, and is also a zoonosis. It is also associated with diarrhoea mainly in children less than five years of age. In Tanzania however, no study has addressed Rotavirus in livestock species. Following our previous report on Rotavirus infection in children within urban and peri-urban Arusha, we sought to understand the disease situation in livestock in the same area.

STUDY DESIGN: Place and Duration of Study: In this study, we investigated the prevalence of Rotavirus in pigs of suckling, weaning and post weaning/grazing/fattening age categories in Lemara, Moshono and Sokoni I areas of Arusha peri-urban.

METHODOLOGY: Molecular detection of Rotavirus in stool samples was done using conventional PCR with primers targeting Group A Rotavirus (GARV). Using a standardized questionnaire, we sought to find out risk factors associated with positive cases of Rotavirus including age, sex, location, diarrhoea status, recent diarrhoea case in the farm, breed, type of grazing system and type of feeding of individual pigs.

RESULTS: Out of a total of 110 pigs sampled (fecal samples), 41.8% were positive for Rotavirus. Chi Square's (χ^2) Fisher's Exact Test was used to relate PCR test results with various possible risk factors. Recent diarrhoea case in the farm was significantly ($p < 0.05$) associated with Rotavirus infection in pigs indicating the possible role of cross-infection within farm and also the environmental resistance and persistence of the virus in the farm.

CONCLUSIONS: This was the first study to report on Rotavirus infection in pigs in Tanzania. The information obtained should form the platform for further studies to address the molecular epidemiology and relatedness of Rotavirus from human and porcine positive cases.

Keywords: Pigs/Swine, Group A Rotavirus, Diarrheal Prevalence, Tanzania

85. Emerging viral infectious disease threat: Why Tanzania is not in a safe zone

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Authors' information

ABSTRACT

Emerging diseases are global threat towards human existence. Every country is exposed to potentially emergence of infectious diseases. Several factor such as changes in ecology, climate and human demographics play different roles in a complex mechanism contributing to the occurrence of infectious diseases. Important aspects towards control in case of outbreaks are surveillance, preparedness and early response. Tanzania should therefore take opportunity of the calm situation currently present, to prepare. Except for HIV/AIDS, Tanzania has not experienced a major public health threat. However, the question is, is the country safe from emerging and re-emerging infectious diseases? In this article we try to explore the danger of emerging infectious disease (EID) epidemics in Tanzania and the risks attached if an outbreak is to occur. The aim is to formulate recommendations to the government, responsible authorities and general population of what can be done to improve the level of EID preparedness in the country. In conclusion, it is important to strengthen the capacity of community and healthcare staffs on how to respond to potential infectious disease outbreaks. Community-based surveillance systems should be incorporated into the national systems for early detection of public health events. It is also critical to enhance one health approach to increase cross-sectoral information sharing, surveillance and interventional strategies as regards to preparedness and response to disease outbreaks.

Keywords: emerging, virus diseases, threat, epidemics, preparedness, Tanzania

86. The Use of Guidelines for Lower Respiratory Tract Infections in Tanzania: A Lesson from Kilimanjaro Clinicians.

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ABSTRACT

BACKGROUND: Evaluations of the guidelines for the management of Lower Respiratory Tract Infections (LRTI) Sub-Saharan Africa, particularly in Tanzania is scant. **Objective:** The aim of the

study was to assess the usefulness of the current Tanzanian treatment guideline for the management lower respiratory tract infection.

METHODS: A descriptive cross-sectional study in 11 hospitals of different levels in the Kilimanjaro region Data were collected from May 2012 to July 2012 by semi-structured interview for clinicians using 2 dummy cases for practical assessment. Data were analyzed by STATA v11 (StataCorp, TX, USA). Qualitative narratives from the interviews were translated, transcribed then coded by colors into meaningful themes.

RESULTS: A variety of principles for diagnosing and managing LRTI were demonstrated by 53 clinicians of Kilimanjaro. For the awareness, 67.9% (36/53) clinicians knew their responsibility to use Standard Treatment Guideline for managing LRTI. The content derived from Standard Treatment Guideline could be cited by 11.3% of clinicians (6/53) however they all showed concern of gaps in the guideline. Previous training in the management of patients with LRTI was reported by 25.9% (14/53), majority were pulmonary TB related. Correct microorganisms causing different forms of LRTI were mentioned by 11.3% (6/53). Exact cause of A typical pneumonia and Q fever as an example was stated by 13.0% (7/53) from whom the need of developing the guideline for LRTI was explicitly elaborated.

CONCLUSION: The current guidelines have not been used effectively for the management of LRTI in Tanzania. There is a need to review its content for the current practical use.

Keywords: Atypical pneumonia, Clinicians, Community acquired, Lower respiratory tract infections, pneumonia, Q fever, Quality of health care, Sub-Saharan Africa, Tanzania

87. Antibiotic resistance of *Streptococcus pneumoniae* colonising the nasopharynx of HIV-exposed Tanzanian infants

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ABSTRACT

OBJECTIVES: To determine antibiotic susceptibility of colonizing pneumococcal serotypes in HIV-exposed infants before the introduction of the 13-valent pneumococcal conjugate vaccine (PCV13), because HIV-exposed infants are at increased risk of invasive pneumococcal infections.

METHODS: Antibiotic susceptibility of 104 pneumococcal isolates, cultured from the nasopharynx from Tanzanian HIV-exposed infants, was determined using the disc diffusion method and the *E*-test according to EUCAST version 4.0 (2014) criteria.

RESULTS: A total of 69.2% of isolates were intermediately susceptible for benzyl penicillin (MIC 0.06–2 mg/l); no high-level resistance was found. All isolates but one was susceptible to ampicillin. Regarding non-beta-lactam antibiotics, 19.2% of isolates were resistant to doxycycline, 3.8% to erythromycin and 97.1% to trimethoprim/sulfamethoxazole. A total of 15.4% of isolates were resistant to three antibiotic classes or more. There were no differences in antibiotic susceptibility between vaccine and non-vaccine serotypes. Reduced susceptibility of colonizing pneumococcal isolates for commonly used antibiotics is common in HIV-exposed Tanzanian infants.

CONCLUSIONS: High-dose penicillin and ampicillin remain appropriate first choices for non-meningeal pneumococcal infections in this group.

Keywords: invasive pneumococcal infections, Tanzania

88. Factors associated with colonization of *Streptococcus pneumoniae* among under-fives attending clinic in Mwanza City, Tanzania

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ABSTRACT

BACKGROUND: *Streptococcus pneumoniae* is a known cause of severe invasive bacterial infection leading to morbidity and mortality among children in sub-Saharan Africa. Nasopharyngeal colonization of *S. pneumoniae* is a critical step towards invasive disease progression. The objective of this study was to investigate the magnitude of nasopharyngeal carriage of *S. pneumoniae* and its associated factors in Mwanza, Tanzania.

METHODS: Children underfives attending Reproductive and Child Health (RCH) clinics in Mwanza, Tanzania clinics were enrolled and investigated for nasopharyngeal carriage of *S. pneumoniae*. Demographic and clinical data were collected using standardized data collection tool. Nasopharyngeal swabs were taken and processed as per standard laboratory procedures. *S. pneumoniae* isolates were identified using conventional methods. Antimicrobial susceptibility testing was performed using the disc diffusion method as described by Clinical Laboratory Standard Institute.

RESULTS: Among 350 children enrolled in the study, 172 (49.1) were females and 309 (88.3%) were below 2 years of age. A total of 253 (72.3%) children had received at least one dose of pneumococcal vaccine (Prevanar 13) whereas 83 (23.7%) had used antibiotics at median

duration of 5 days in the past 14 days. Out of 350 underfives, 43 (12.3%) were found to carry *S. pneumoniae* in their nasopharynx. Children with chronic diseases and those at school were 3.4 and 4.4 times more at risk to be carriers of *S. pneumoniae* than their counterpart group (OR; 3.4 (CI (1.0-11.6) 95%, p=0.05) and OR; 4.4 (CI (1.2-15.7) 95%, p=0.023), respectively. Number of children at home, positive HIV status and someone smoking showed association with *S. pneumoniae* carriage but the differences were not statistically significant. The resistance levels of *S. pneumoniae* to penicillin, co-trimoxazole and erythromycin were 40%, 88.2% and 41.7%, respectively. However, all of the *S. pneumoniae* isolates were found to be 100% sensitive to ciprofloxacin.

CONCLUSION: A high nasopharyngeal carriage of penicillin resistant *S. pneumoniae* is observed in Mwanza, Tanzania despite a good coverage of pneumococcal vaccination. The carriage is significantly associated with schooling and presence chronic diseases. Continuous surveillance of penicillin resistant strains coupled with serotyping of the isolates is highly recommended to determine the influence of the pneumococcal vaccination.

Keywords: Streptococcus pneumoniae, penicillin resistant, colonization, children, Tanzania

89. Biomarkers of Host Response Predict Primary End-Point Radiological Pneumonia in Tanzanian Children with Clinical Pneumonia: A Prospective Cohort Study

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ABSTRACT

BACKGROUND: Diagnosing pediatric pneumonia is challenging in low-resource settings. The World Health Organization (WHO) has defined primary end-point radiological pneumonia for use in epidemiological and vaccine studies. However, radiography requires expertise and is often inaccessible. We hypothesized that plasma biomarkers of inflammation and endothelial activation may be useful surrogates for end-point pneumonia, and may provide insight into its biological significance.

METHODS: We studied children with WHO-defined clinical pneumonia (n = 155) within a prospective cohort of 1,005 consecutive febrile children presenting to Tanzanian outpatient clinics. Based on x-ray findings, participants were categorized as primary end-point pneumonia

(n = 30), other infiltrates (n = 31), or normal chest x-ray (n = 94). Plasma levels of 7 host response biomarkers at presentation were measured by ELISA. Associations between biomarker levels and radiological findings were assessed by Kruskal-Wallis test and multivariable logistic regression. Biomarker ability to predict radiological findings was evaluated using receiver operating characteristic curve analysis and Classification and Regression Tree analysis.

RESULTS: Compared to children with normal x-ray, children with end-point pneumonia had significantly higher C-reactive protein, procalcitonin and Chitinase 3-like-1, while those with other infiltrates had elevated procalcitonin and von Willebrand Factor and decreased soluble Tie-2 and endoglin. Clinical variables were not predictive of radiological findings. Classification and Regression Tree analysis generated multi-marker models with improved performance over single markers for discriminating between groups. A model based on C-reactive protein and Chitinase 3-like-1 discriminated between end-point pneumonia and non-end-point pneumonia with 93.3% sensitivity (95% confidence interval 76.5–98.8), 80.8% specificity (72.6–87.1), positive likelihood ratio 4.9 (3.4–7.1), negative likelihood ratio 0.083 (0.022–0.32), and misclassification rate 0.20 (standard error 0.038).

CONCLUSIONS: In Tanzanian children with WHO-defined clinical pneumonia, combinations of host biomarkers distinguished between end-point pneumonia, other infiltrates, and normal chest x-ray, whereas clinical variables did not. These findings generate pathophysiological hypotheses and may have potential research and clinical utility.

Keywords: Pneumonia, Children, Tanzania

90. Quantification of Human Norovirus GII on Hands of Mothers with Children under the Age of Five Years in Bagamoyo, Tanzania

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ABSTRACT

Human noroviruses are the most common cause of viral gastroenteritis worldwide and one of the leading causes of viral diarrhea in children under the age of 5 years. Hands have been shown to play an important role in norovirus transmission. Norovirus outbreaks tend to exhibit strong seasonality, most often occurring during cold, dry months, but recently have also been documented during hot, dry winter months in the southern hemisphere. Other research suggests that rainfall is an important factor in norovirus outbreaks. This study examines the prevalence and concentration of human norovirus GII on the hands of mothers in Bagamoyo, Tanzania, during the rainy and dry seasons. Norovirus GII was detected in approximately 5% of hand rinse samples during both the rainy and dry seasons. Fecal indicator bacteria levels, *Escherichia coli* and enterococci, in hand rinse samples were not associated with norovirus hand contamination. Turbidity of the hand rinses was found to be associated with norovirus presence on mothers'

hands; however, this relationship was only observed during the rainy season. The results suggest mothers' hands serve as a source of norovirus exposure for young children in Tanzanian households, and further work is needed to determine better indicators of norovirus contamination in these environments.

Keywords: Human noroviruses, Tanzania, Bagomoyo

91. Molecular Epidemiology of Human Rhinoviruses and Enteroviruses Highlights Their Diversity in Sub-Saharan Africa

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ABSTRACT

Human rhinoviruses (HRVs) and enteroviruses (HEVs) belong to the Enterovirus genus and are the most frequent cause of infection worldwide, but data on their molecular epidemiology in Africa are scarce. To understand HRV and HEV molecular epidemiology in this setting, we enrolled febrile paediatric patients participating in a large prospective cohort assessing the causes of fever in Tanzanian children. Naso/oropharyngeal swabs were systematically collected and tested by real-time RT-PCR for HRV and HEV. Viruses from positive samples were sequenced and phylogenetic analyses were then applied to highlight the HRV and HEV types as well as recombinant or divergent strains. Thirty-eight percent (378/1005) of the enrolled children harboured an HRV or HEV infection. Although some types were predominant, many distinct types were co-circulating, including a vaccine poliovirus, HEV-A71 and HEV-D68. Three HRV-A recombinants were identified: HRV-A36/HRV-A67, HRV-A12/HRV-A67 and HRV-A96/HRV-A61. Four divergent HRV strains were also identified: one HRV-B strain and three HRV-C strains. This is the first prospective study focused on HRV and HEV molecular epidemiology in sub-Saharan Africa. This systematic and thorough large screening with careful clinical data management confirms the wide genomic diversity of these viruses, brings new insights about their evolution and provides data about associated symptoms. View Full-Text

Keywords: picornavirus; rhinovirus; enterovirus; molecular epidemiology; recombinant; new type; children; fever; Tanzania; emergent

92. Respiratory Disease in Chimpanzees of Gombe Stream National Park, Tanzania: Advancing Non-invasive Methods in Epidemiology

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ABSTRACT

In a world of increasing wildlife habitat loss, a growing human population, and expanding connectivity between human, domestic animal and wildlife populations, emerging infectious diseases (EIDs) are ever more a complex and disturbing issue. Primates are recognized as an important taxon in EID research, as they may be sentinels, reservoir hosts, or cases in spill over events. Hence, from both public health and conservation perspectives, there is a critical need for disease surveillance in primate populations. The research described in this dissertation focused on the validation of tools and methods for respiratory disease surveillance in free-living primate populations. In conjunction, was the advancement of non-invasive methods of disease surveillance. This endeavour was undertaken to balance the need to better understand respiratory disease impacts with the goal of no disruption to the natural behaviour of the study population for health data collection. Accordingly, this dissertation includes a systematic qualitative and quantitative evaluation of the performance of syndromic surveillance in the detection of respiratory outbreaks in Gombe Stream National Park, Tanzania from 2004-2012, as well as an epidemiological study of those outbreaks. As most of our understanding of respiratory disease in great ape populations originates from studies of major outbreaks, consisting of large-scale morbidity and mortality, this work offers new insights into the dynamics of ostensibly endemic disease trends. The final component of this research was the validation of a non-invasive approach, the application of molecular techniques to faeces, for the detection tuberculosis in free-living primates. Thus, the research described in this dissertation exemplifies the direction that future surveillance for disease should take in primate populations: building on syndromic surveillance with the incorporation of non-invasive diagnostic sampling. The coupling of syndromic surveillance with targeted non-invasive, diagnostic sampling during endemic or epidemic disease outbreaks, will generate a powerful system for studying respiratory disease transmission and population impacts among free-living primates.

Keywords: emerging infectious diseases

93. Prevalence and molecular characterization of human adenovirus in diarrheic children in Tanzania; a case control study

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ABSTRACT

Background: Human adenovirus (HAdV) causes acute diarrhoea sporadically, as well as in outbreaks. Understanding the prevalence and types of HAdV in diarrhoea is important for control and preventive measures, especially in the African region where there is a high burden of diarrhoeal disease. The present study assessed the prevalence, molecular characteristics, seasonality and associated clinical features of HAdV infection in Tanzanian children below two years of age with and without diarrhoea between 2010–2011.

METHODS: Stool specimens, demographic and clinical information were collected in 690 cases and 545 controls. All stool samples were screened for HAdV-antigen using ELISA. Positive samples subsequently underwent real-time PCR and sequencing for molecular typing.

RESULTS: HAdV was detected in 37 children, corresponding to a prevalence of 3.5% (24/690) in diarrhoeic and 2.4% (13/545) in non-diarrhoeic children ($P > 0.05$). Among HAdV-infected children, the median age was significantly lower in diarrhoeic than in non-diarrhoeic children (10 vs. 14 months, $P < 0.001$). More than half of HAdV-infected (54.2%) were dehydrated as compared to diarrhoeic children without HAdV (45.8%, $P = 0.01$). The proportion of the enteric HAdV type 40/41 in diarrhoeic and non-diarrhoeic children was (50.0%, 12/24) and (46.2%, 6/13) respectively. Other HAdV types detected were; 1, 2, 7, 18, 19 and 31. The prevalence of adenovirus was not significantly different between rainy and dry seasons. HAdV was not detected in the 33 known HIV positive children. There was no significant association between HAdV infection and gender, nutritional status of the child and parent educational level.

CONCLUSION: The present study provides further evidence of the contribution of adenovirus in causing gastroenteritis in young children, with symptomatic infection being significantly more prevalent in children below one year. We found similar prevalence of adenovirus in non-diarrhoeic children and in diarrhoeic children. This first report on molecular epidemiology of human adenovirus in Tanzania observed diversity of HAdV types that circulate in the study setting. The study findings suggest that HAdV is not an important cause of diarrhoea in young HIV-positive children.

Keywords: Human adenovirus, Tanzania, Diarrhoea

94. Dengue and Chikungunya Fever among Viral Diseases in Outpatient Febrile Children in Kilosa District Hospital, Tanzania

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ABSTRACT

INTRODUCTION: Viral aetiologies of fever, including dengue, Chikungunya, influenza, rota and adeno viruses, cause major disease burden in tropical and subtropical countries. The lack of diagnostic facilities in developing countries leads to failure to estimate the true burden of such illnesses, and generally the diseases are underreported. These diseases may have similar symptoms with other causes of acute febrile illnesses including malaria and hence clinical diagnosis without laboratory tests can be difficult. This study aimed to identify viral aetiologies as a cause of fever in children and their co-infections with malaria.

METHODS: A cross sectional study was conducted for 6 months at Kilosa district hospital, Tanzania. The participants were febrile children aged 2–13 years presented at the outpatient department. Diagnostic tests such as IgM and IgG ELISA, and PCR were used.

RESULTS: A total of 364 patients were enrolled, of these 83 (22.8%) had malaria parasites, 76 (20.9%) had presumptive acute dengue infection and among those, 29(38.2%) were confirmed cases. Dengue was more likely to occur in children ≥ 5 years than in <5 years (OR 2.28, 95% CI: 1.35–3.86). Presumptive acute Chikungunya infection was identified in 17(4.7%) of patients. We observed no presenting symptoms that distinguished patients with Chikungunya infection from those with dengue infection or malaria. Co-infections between malaria and Chikungunya, malaria and dengue fever as well as Chikungunya and dengue were detected. Most patients with Chikungunya and dengue infections were treated with antibacterials. Furthermore, our results revealed that 5(5.2%) of patients had influenza virus while 5(12.8%) had rotavirus and 2(5.1%) had adenovirus.

CONCLUSION: Our results suggest that even though viral diseases are a major public health concern, they are not given due recognition as a cause of fever in febrile patients. Emphasis on laboratory diagnostic tests for proper diagnosis and management of febrile patients is recommended.

Keywords: Viral diseases, Children, febrile

95. Hands and Water as Vectors of Diarrheal Pathogens in Bagamoyo, Tanzania

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ABSTRACT

Diarrheal disease is a leading cause of under-five childhood mortality worldwide, with at least half of these deaths occurring in sub-Saharan Africa. Transmission of diarrheal pathogens occurs through several exposure routes including drinking water and hands, but the relative importance of each route is not well understood. Using molecular methods, this study examines the relative importance of different exposure routes by measuring enteric bacteria (pathogenic *Escherichia coli*) and viruses (rotavirus, enterovirus, adenovirus) in hand rinses, stored water, and source waters in Bagamoyo, Tanzania. Viruses were most frequently found on hands, suggesting that hands are important vectors for viral illness. The occurrence of *E. coli* virulence genes (ECVG) was equivalent across all sample types, indicating that both water and hands are important for bacterial pathogen transmission. Fecal indicator bacteria and turbidity were good predictors of ECVG, whereas turbidity and human-specific *Bacteroidales* were good predictors of viruses. ECVG were more likely found in unimproved water sources, but both ECVG and viral genes were detected in improved water sources. ECVG were more likely found in stored water of households with unimproved sanitation facilities. The results provide insights into the distribution of pathogens in Tanzanian households and offer evidence that hand-washing and improved water management practices could alleviate viral and bacterial diarrhea.

Keywords: rotavirus, enterovirus, adenovirus, Tanzania, *E. coli* virulence genes

96. Mass Distribution of Azithromycin for Trachoma Control Is Associated with Increased Risk of Azithromycin-Resistant *Streptococcus pneumoniae* Carriage in Young Children 6 Months After Treatment

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ABSTRACT

BACKGROUND: Emerging evidence suggests that the mass distribution of azithromycin for trachoma control (MDA) may increase circulation of macrolide resistance in bacteria associated with severe pediatric infections in treated communities.

METHODS: We examined the effect of MDA on nasopharyngeal carriage of antibiotic-resistant *Streptococcus pneumoniae* among 1015 young children living in rural Tanzania. MDA with a single dose of oral azithromycin was provided in 4 of 8 communities where trachoma prevalence was $\geq 10\%$. Isolates were tested for susceptibility to azithromycin (AZM) and commonly used antibiotics by disk diffusion and Etest. We calculated the proportion of antibiotic-resistant *S. pneumoniae* carriage at baseline and again 1, 3, and 6 months after treatment, and at comparable intervals in the untreated villages.

RESULTS: The proportion of AZM-resistant isolates was similar between groups at baseline (MDA: 35.8% vs nonMDA: 35.4%), however, this proportion was greater in the MDA group in all subsequent surveys. At 6 months, the percentage of AZM-resistant isolates was significantly higher in the MDA group (81.9% vs 46.9%, $P < .001$). The odds of AZM-resistant carriage was 5-fold greater in the MDA group (odds ratio, 4.95 [95% confidence interval, 3.23–7.61]). The proportion of isolates clinically resistant to AZM (minimum inhibitory concentration $\geq 16 \mu\text{g/mL}$) was also significantly greater in the MDA group at 6 months (35.3% vs 12.4%, $P < .006$).

CONCLUSIONS: Mass distribution of a single dose of oral azithromycin for trachoma was associated with increased circulation of macrolide-resistant *S. pneumoniae* carriage among young children in the 6 months following treatment. It is crucial that changes in antibiotic resistance patterns and their clinical significance in the treatment of severe paediatric infections be assessed in future MDA trials.

Keywords: trachoma; azithromycin; *S. pneumoniae*; antimicrobial resistance; children

97. Results from the First 30 Months of National Sentinel Surveillance for Influenza in Tanzania, 2008–2010

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ABSTRACT

Limited data exist on the burden of influenza in developing countries. In 2008, in order to better understand the epidemiology of influenza virus infection in Tanzania, the Tanzanian Ministry of Health and Social Welfare created a sentinel surveillance system for influenza. At 5 hospitals across the country, patients with influenza-like illness (ILI) and severe acute respiratory illness (SARI) had oropharyngeal and nasopharyngeal samples collected. At the National Influenza Center in Dar es Salaam, specimens were tested for influenza using real-time polymerase chain reaction tests. From May 2008 through November 2010, a total of 1794 samples were collected from 5 sentinel sites, of which 61% were from patients with ILI and 39% were from patients with SARI. Of all ILI and SARI samples, 8.0% were positive for influenza; 6.9% yielded influenza A virus, and 1.1% yielded influenza B virus. Most influenza A virus was subtype H3, which circulated in nearly every month of 2010. The proportion of influenza-positive cases was similar among ILI (8.5%) and SARI (7.3%) patients ($P = .39$). In multivariate logistic regression, influenza-positive SARI cases were more likely than influenza-negative SARI cases to have had rhonchi (adjusted OR [aOR], 2.31; 95% confidence interval [CI], 1.14–4.67), nasal discharge (aOR, 4.57; 95% CI, 1.30–16.10), and stridor (aOR, 2.63; 95% CI, 1.17–5.90). Influenza-positive ILI patients had a longer duration of fever on presentation, compared with influenza-negative ILI patients (median, 4 vs 3 days; $P = .004$). Otherwise, there was no difference in signs or symptoms among influenza-positive and influenza-negative ILI patients. During 2.5 years of surveillance for influenza at 5 geographically dispersed sites in Tanzania, we found that influenza circulated year-round. Surveillance should continue in order to fully understand the seasonality and epidemiology of influenza in Tanzania.

Keywords: influenza, influenza a virus, orthomyxoviridae, sentinel surveillance, Tanzania, surveillance, medical

98. Penicillin resistance and serotype distribution of *Streptococcus pneumoniae* in nasopharyngeal carrier children under 5 years of age in Dar es Salaam, Tanzania

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ABSTRACT

This study aimed to determine the magnitude of nasopharyngeal carriage, antimicrobial resistance and serotype distribution of *Streptococcus pneumoniae* in healthy children under 5 years of age in Tanzania. Nasopharyngeal swabs were obtained from 300 healthy children attending a child health clinic at Muhimbili National Hospital in Dar es Salaam, Tanzania. *S. pneumoniae* was isolated and identified using conventional methods. Antimicrobial susceptibility testing was performed using the Kirby–Bauer disc diffusion method. Penicillin MICs and serotypes were determined by an agar gradient diffusion method and the Quellung reaction, respectively. A total of 105 samples (35.0%) were positive for *S. pneumoniae* and 115 serotypes were detected (ten specimens yielded two serotypes each). Overall, 78 of 115 isolates (67.8%) were penicillin-non-susceptible pneumococci (PNSP). The resistance levels of *S. pneumoniae* to trimethoprim-sulfamethoxazole, tetracycline, erythromycin, chloramphenicol and ceftriaxone were 82.6, 10.4, 6.0, 3.5 and 0.0%, respectively. Multidrug resistance was detected in 19 isolates (16.5%). The most prevalent serotypes were 19F ($n=25$, 21.7%), 6B ($n=15$, 13.0%), 9V ($n=14$, 12.2%) and 13 ($n=14$, 12.2%). Of the 64 pneumococcal isolates potentially covered by the seven-valent pneumococcal conjugate vaccine (PCV7), 44 (68.8%) were PNSP. A high prevalence of PNSP, common pneumococcal serotypes circulating worldwide, was found, and many of the resistant pneumococci strains are covered by the PCV7. These findings indicate that the carriage rate of such resistant strains could be influenced by an appropriate vaccination programme in the study setting and by reinforcing regulations on the rational use of antimicrobial agents.

Keywords: *Streptococcus pneumoniae*, penicillin, Tanzania

99. Nasopharyngeal carriage of *Streptococcus pneumoniae*: prevalence and risk factors in HIV-positive children in Tanzania

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ABSTRACT

BACKGROUND: Pneumococcal colonization of the nasopharynx is especially common in young children and is a pre-requisite for pneumococcal disease. Those with immunosuppression, such as HIV, are at higher risk of colonization and disease, especially at older ages. Currently, vaccination schedules are only offered to children under 6 months of age, despite the large impact of pneumococcal disease in older unvaccinated children with HIV. We conducted a study to assess the prevalence of, and risk factors for, pneumococcal carriage in HIV-positive children aged <15 years.

METHODS: We collected a single nasopharyngeal swab from 142 HIV-infected children aged 1–14 years over a 2-month period. To detect carriage of pneumococcus, these samples were cultured and serotyped; PCR was performed on negative samples. We also collected epidemiological data via survey and medical records.

RESULTS: The overall carriage rate was 81% and was at least 76% in those aged 5–14 years. The 7-, 10-, and 13-valent pneumococcal vaccines would cover 37%, 37%, and 49% of children with carriage, respectively. In the multivariate analysis, we identified increase in weight since last visit ($p = 0.028$) and the existence of care-givers who had respiratory symptoms in the past week ($p = 0.022$) as risk factors for carriage. Weight gain was also significantly associated with antiretroviral use ($p = 0.002$).

CONCLUSIONS: These data illuminate the little known area of pneumococcal carriage in older HIV-infected children as well as finding novel risk factors for pneumococcal carriage, namely the association with household members who have respiratory symptoms and with an increase in the child's weight prior to swabbing. Weight gain may be due to an increase in health enabling more mobility and increasing the risk of acquiring carriage. The carriage rate observed (81%) is one of the highest recorded. Further research should address whether vaccination can prevent the acquisition of carriage and so protect against disease.

Keywords: Nasopharyngeal carriage, *Streptococcus pneumoniae*, HIV, Child, Risk factor

100. Are we prepared for emerging and re-emerging diseases? Experience and lessons from epidemics occurred in Tanzania during the last five decades

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ABSTRACT

This paper reviews preparedness for containing and controlling emerging and re-emerging diseases drawing lessons from disease events that occurred in animal and human populations in the last five decades (1961-2011). A comprehensive analysis based on retrieval and analysis of grey and published literature as well as reported cases was carried out to document type and trend of occurrence of emerging and re-emerging infectious diseases in different parts of Tanzania. Overall, the majority of diseases reported in the country were viral in nature followed by bacterial diseases. The trend for the occurrence shows a number of new emerging diseases as well as re-occurrence of old diseases in both animal (domestic and wild) and human populations. In humans, the major disease epidemics reported in the last five decades include cholera, influenza A H1N1, plague and rubella. In animals, the major epidemic diseases reported were Contagious Bovine Pleuropneumonia, Contagious Caprine Pleuropneumonia, Peste des petits ruminants and Giraffe Ear and Skin Diseases. Some epidemics have been reported in both human and animal populations including Rift Valley fever and anthrax. The emergence of the 'fit-for purpose' approaches and technologies such as the discipline of One Health, use of participatory epidemiology and disease surveillance and mobile technologies offers opportunity for optimal use of limited resources to improve early detection, diagnosis and response to disease events and consequently reduced impact of such diseases in animal and human populations.

Keywords: emerging and re-emerging infectious diseases, outbreak, trends, preparedness, Tanzania

101. Multiplex reverse transcription PCR Luminex assay for detection and quantitation of viral agents of gastroenteritis

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ABSTRACT

BACKGROUND: Several viruses can cause diarrheal disease, a leading cause of morbidity and mortality worldwide. Existing diagnostic methods include ELISA and nucleic acid amplification, usually performed individually.

OBJECTIVES: (1) To develop a multiplexed assay for simultaneous detection of major enteric viral pathogens. (2) Quantitation of viral load by normalizing with an extrinsic control.

STUDY DESIGN: A simple protocol combining a one-step multiplex reverse transcription-polymerase chain reaction (RT-PCR) with microsphere-based fluorescence detection was developed for norovirus GI and GII, rotavirus, astrovirus, sapovirus, and adenovirus. An extrinsic

control, bacteriophage MS2, was spiked into each faecal sample before nucleic acid extraction to normalize between samples for the efficiency of nucleic acid extraction and amplification.

RESULTS: The fluorescent results were quantitative and nearly as sensitive as the corresponding singleplex real time RT-PCR (qRT-PCR) assay on analytic samples. Upon testing 229 faecal samples from inpatients with diarrhoea in Tanzania the assay yielded between 88% and 100% sensitivity and specificity for all analyses. The difference in fluorescence intensities of MS2 between samples indicated variable extraction efficiency and was used to better refine the viral load of each specimen.

CONCLUSIONS: This one-step nucleic acid-based assay enables rapid, sensitive and specific detection of the major viral causes of gastroenteritis. The quantitation yielded by the assay is informative for clinical research particularly in the context of mixed infections.

Keywords: Virus, Gastroenteritis, PCR, Rotavirus, Diarrhoea

102. Invasive Bacterial and Fungal Infections Among Hospitalized HIV-Infected and HIV-Uninfected Adults and Adolescents in Northern Tanzania

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ABSTRACT

BACKGROUND: Few studies describe patterns of human immunodeficiency virus (HIV) co-infections in African hospitals in the antiretroviral therapy (ART) era.

METHODS: We enrolled consecutive admitted patients aged ≥ 13 years with oral temperature of $\geq 38.0^{\circ}\text{C}$ during 1 year in Moshi, Tanzania. A standardized clinical history and physical examination was done and hospital outcome recorded. HIV antibody testing, aerobic and mycobacterial blood cultures, and malaria film were performed. HIV-infected patients also received serum cryptococcal antigen testing and CD4⁺ T lymphocyte count (CD4 cell count).

RESULTS: Of 403 patients enrolled, the median age was 38 years (range, 14–96 years), 217 (53.8%) were female, and 157 (39.0%) were HIV-infected. Of HIV-infected patients, the median

CD4 cell count was 98 cells/ μ L (range, 1–1,105 cells/ μ L), 20 (12.7%) were receiving ART, and 29 (18.5%) were receiving trimethoprim-sulfamethoxazole prophylaxis. There were 112 (27.7%) patients who had evidence of invasive disease, including 26 (23.2%) with *Salmonella* serotype Typhi infection, 24 (21.4%) with *Streptococcus pneumoniae* infection, 17 (15.2%) with *Cryptococcus neoformans* infection, 12 (10.7%) with *Mycobacterium tuberculosis* complex infection, 8 (7.1%) with *Plasmodium falciparum* infection, and 7 (6.3%) with *Escherichia coli* infection. HIV infection was associated with *M. tuberculosis* and *C. neoformans* bloodstream infection but not with *E. coli*, *S. pneumoniae*, or *P. falciparum* infection. HIV infection appeared to be protective against *Salmonella* Typhi bloodstream infection (odds ratio, .12; $P = .001$).

CONCLUSIONS: While *Salmonella* Typhi and *S. pneumoniae* were the most common causes of invasive infection overall, *M. tuberculosis* and *C. neoformans* were the leading causes of bloodstream infection among HIV-infected inpatients in Tanzania in the ART era. We demonstrate a protective effect of HIV against *Salmonella* Typhi bloodstream infection in this setting. HIV co-infections continue to account for a large proportion of febrile admissions in Tanzania.

Keywords: *Streptococcus pneumoniae*, Tanzania

103. The adaptive potential during nasopharyngeal colonization of *Streptococcus pneumoniae*

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ABSTRACT

Adaptation to host defenses and antimicrobials is critical for *Streptococcus pneumoniae* (the pneumococcus) during colonization of the nasopharynx – its only ecological habitat. The pneumococcus is highly transformable with the genome between different strains varying widely in both gene content and gene sequence. Thus, mixed strains colonizing together will expand the genetic reservoir – “supragenome” for this highly transformable microorganism, increasing its adaptive potential. The extent of the phenotypic and genotypic diversity of strains co-colonizing in the nasopharynx was determined. In contrast to most carriage studies, which characterize single colonies, a systematic analysis of up to 20 colonies per colonization was undertaken in Tanzanian children for 12 months. The serotype was determined by conventional serology and confirmed by DNA-based methods. The antibiotic susceptibility for penicillin and co-trimoxazole was determined from the minimum inhibitory concentration determined by *E*-test. As representative of the genotype of strains the sequence types (STs) was determined by multilocus sequence typing (MLST). Of 61 colonization events studied, seven (11.5%) had strains expressing multiple serotypes, with a maximum of five serotypes detected. Four colonization events also had co-colonization of penicillin and/or co-trimoxazole susceptible and non-susceptible pneumococci.

Sequence typing revealed that 58% were unique to our cohort. Simultaneous colonization of up to six STs with two expressing serotype 6B was seen. Re-isolation of either the same or different strains of serotype 6B was seen. Genetically related single-locus and double-locus variants were identified in our cohort that differed by multiple nucleotides. Multiple colony characterization revealed phenotypic and genetic evidence of microevolution and a greater diversity of pneumococcal strains colonizing together than previously observed, thus increasing the potential to adapt in response to the host environment during colonization.

Keywords: Streptococcus pneumoniae, Multiple colonisations, Multilocus sequence typing, Adaptation, Genetic diversity, Nasopharyngeal carriage

104. Identification of Adenoviruses in Fecal Specimens from Wild Chimpanzees (*Pan troglodytes schweinfurthii*) in Western Tanzania

Suxiang Tong, Jatinder Singh, Susan Ruone, Charles Humphrey, Cyril C. Y. Yip, Susanna K. P. Lau, Larry J. Anderson, and Taranjit Kaur

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ABSTRACT

DNA of two distinctive adenoviruses was detected in wild chimpanzees in western Tanzania that showed clinical signs of acute, upper respiratory disease, notably coughing. The amplified sequences from part of the capsid hexon gene suggests that one virus is a novel adenovirus serotype candidate and the other virus is a species C adenovirus most closely related to recent isolates from captive chimpanzees in the United States, Simian AdV 37 with 86% nucleic acid identity and Simian AdV 40 with 95% nucleic acid identity, respectively. The species C adenovirus sequences suggest possible recombination with a human adenovirus. The source of these viruses and disease association is not known.

Keywords: Adenoviruses, Tanzania

105. Prevalence of enteropathogenic viruses and molecular characterization of group A rotavirus among children with diarrhea in Dar es Salaam Tanzania

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ABSTRACT

BACKGROUND: Different groups of viruses have been shown to be responsible for acute diarrhoea among children during their first few years of life. Epidemiological knowledge of viral agents is critical for the development of effective preventive measures, including vaccines.

METHODS: In this study we determined the prevalence of the four major enteropathogenic viruses – rotavirus, norovirus, adenovirus and astrovirus – was determined in 270 stool samples collected from children aged 0 – 60 months who were admitted with diarrhoea in four hospitals in Dar es Salaam, Tanzania, using commercially available ELISA kits. In addition, the molecular epidemiology of group A rotavirus was investigated using reverse transcriptase multiplex polymerase chain reaction (RT-PCR).

RESULTS: At least one viral agent was detected in 87/270 (32.2%) of the children. The prevalence of rotavirus, norovirus, adenovirus and astrovirus was 18.1%, 13.7%, 2.6% and 0.4%, respectively. In most cases (62.1%) of viruses were detected in children aged 7–12 months. The G and P types (VP7 and VP4 genotypes respectively) were further investigated in 49 rotavirus ELISA positive samples. G9 was the predominant G type (81.6%), followed by G1 (10.2%) and G3 (0.2%). P [8] was the predominant P type (83.7%), followed by P [6] (0.4%) and P [4] (0.2%). The following G and P types were not detected in this study population; G2, G4, G8 G10, P [9], P [10] and P [11]. The dominating G/P combination was G9P [8], accounting for 39 (90.7%) of the 43 fully characterized strains. Three (6.1%) of the 49 rotavirus strains could not be typed.

CONCLUSION: Nearly one third of children with diarrhoea admitted to hospitals in Dar es Salaam had one of the four viral agents. The predominance of rotavirus serotype G9 may have implication for rotavirus vaccination in Tanzania.

Keywords: enteropathogenic viruses, rotavirus, Tanzania

106. Prevalences of *Pneumocystis jiroveci*, *Mycobacterium tuberculosis* and *Streptococcus pneumoniae* infection in children with severe pneumonia, in a tertiary referral hospital in northern Tanzania

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ABSTRACT

At the Kilimanjaro Christian Medical Centre, a tertiary referral hospital in northern Tanzania, both the number of paediatric cases of lower respiratory-tract infection (LRTI) and the associated mortality increased between 2000 and 2001. Molecular diagnostic tools were used to enhance the identification of the pathogens responsible for this perceived increase. All 72 children aged between 2 and 60 months who were admitted with LRTI over a 3-month period were enrolled in the study. Induced sputum was collected from each child and, if the parents consented, the subjects were also tested for HIV. The sputum samples were each checked for bacteria by culture and, in amplification assays, for the DNA of *Pneumocystis jiroveci*, *Mycobacterium tuberculosis* and *Streptococcus pneumoniae*. Twenty-two (50%) of the 44 children tested for HIV had HIV-1 antibodies. Although only two children, both aged <6 months, were found PCR-positive for *P. jiroveci*, and only one was found positive for *M. tuberculosis*, 46 (including one of those found positive for *P. jiroveci* and the child found positive for *M. tuberculosis*) were found PCR-positive for *S. pneumoniae*. It therefore appears that most paediatric cases of LRTI who present at the hospital are attributable to *S. pneumoniae*, and that infections with this pathogen are entirely responsible for the observed increase in the incidence of LRTI in the local children. The increase seen in LRTI-associated mortality among the children may be the result of pneumococcal antibiotic resistance.

Keywords: *Streptococcus pneumoniae*, Tanzania, severe pneumonia

107. Influenza A and B antibody status in Tanzania

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ABSTRACT

Sera from 200 babies and young children and from 205 mother-newborn pairs were tested for haemagglutination inhibiting antibody against three A-H1N1, one A-H2N2, four A-H3N2, and two influenza B viruses. The results indicated that a higher concentration of antibody against all

influenza A and B viruses tested was found more frequently in maternal sera than in neonatal sera. High prevalence of antibody and high geometric mean titers against the A-H2N2-1957 and A-H3N2-1968 viruses from the eras 1957–1968 and 1968-now, respectively, were found in the age groups above 15 years. The antibodies against former and recent epidemic influenza viruses of the A-H3N2 subtype, found among different adult age groups in Mwanza, Tanzania, showed a pattern similar to that in the population of The Netherlands.

Keywords: haemagglutination inhibiting antibody, Tanzania

108. Influenza in East Africa

D. Montefiore, S. G. Drozdov, G. W. Kafuko, O. A. Fayinka, and A. Soneji

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<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2427648/>

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ABSTRACT

Very little information is available concerning the frequency of influenza in East Africa. Following recent outbreaks of influenza in Uganda, that were due to the A2/Hong Kong/68 virus, it was considered useful to obtain information relating to the prevalence of infection due to this virus and to the current strain of influenza B virus, not only in Uganda but also in the neighbouring territories of Kenya and Tanzania. The results of serological testing of sera showed that widespread outbreaks of influenza A2/Hong Kong/68 infection had occurred recently in all three territories, while there was evidence of sporadic infection in all territories by the current influenza B strain. Despite the favourable climate of East Africa, it is evident that widespread outbreaks of influenza can occur, and these may arise during the period of the year when influenza is rare in countries with temperate climates. Influenza can easily spread to other countries *via* air travellers to and from East Africa.

Keywords: Influenza B virus, East Africa

155 citations
(Sorted by Partner State)

Uganda



1. Fear of COVID-19 and the Media Influence on Herbal Medication Use in Uganda: A Cross-Sectional Study

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ABSTRACT

BACKGROUND: The coronavirus disease-2019 (COVID-19) pandemic has created fear in people around the world. This has led to the widespread use of various herbal remedies in its prevention and treatment regardless of the paucity of scientific evidence about their safety and efficacy. This study assessed the fear of COVID-19 and the influence of media on the use of herbal medicine to prevent or treat COVID-19 in Uganda.

METHODS: In the first 2 weeks of July 2021, a descriptive online cross-sectional study was carried out anonymously in the general population in Uganda. A validated questionnaire was used to collect data on herbal medicine use and the influence of media. Fear of COVID-19 was rated using the Fear of COVID-19 Scale (FCV-19S).

RESULTS: We recruited 488 participants, 273 (55.9%) were female, with a median age of 25 (range: 18–73) years. Sixty-seven (57.8%) participants had a confirmed COVID-19 diagnosis. The mean FCV-19S score was 21.7 SD 5.9 with 53.3% reporting high levels of COVID-19 fear. About 57.4% of participants reported using herbal remedies either to prevent or treat COVID-19-like symptoms. Media was the main source of information, with more than 80% of the participants reporting seeing or accessing information about herbal medication use. Women (adjusted odds ratio (aOR): 1.74, 95% CI: 1.2–2.5, $p=0.003$) and people with a previously confirmed COVID-19 diagnosis (aOR: 3.1, 95% CI: 1.35–7.14, $p=0.008$) had a statistically significantly higher FCV-19S score. Being unemployed (aOR: 1.0, 95% CI: 1.1–2.3, $p=0.008$) and a female (aOR: 1.0, 95% CI: 1.1–2.3, $p=0.012$) were statistically significantly associated with herbal medicine use. Participants who used herbal remedies had a higher median FCV-19S score compared to non-users (23 versus 21, $p=0.003$) and people with a previously confirmed COVID-19 diagnosis (aOR: 3.1, 95% CI: 1.35–7.14, $p=0.008$) had a statistically significantly higher FCV-19S score. Being unemployed (aOR: 1.0, 95% CI: 1.1–2.3, $p=0.008$) and a female (aOR: 1.0, 95% CI: 1.1–2.3, $p=0.012$) were statistically significantly associated with herbal medicine use. Participants who used herbal remedies had a higher median FCV-19S score compared to non-users (23 versus 21, $p<0.001$).

CONCLUSION: The use of herbal medicines to treat or prevent COVID-19 is a widespread practice among the general population in Uganda amidst the high levels of fear of COVID-19.

Keywords: COVID-19, fear, media, herbal medicine, health awareness, Uganda

2. Assessing Knowledge and Practices of the Community towards Corona Virus Disease 2019 in Mbale Municipality, Uganda: Across Section Study

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ABSTRACT

BACKGROUND: The Coronavirus disease, first identified in Wuhan city, Hubei province of China, is a respiratory illness caused by Novel Corona Virus also known as Severe Acute Respiratory Syndrome Corona Virus 2 (SARS Cov.2). The disease is characterised by; dry cough and shortness of breath with difficulty in breathing and at least 2 of the following; fever, chills, muscle pain, headache, sore throat and loss of test and smell. Uganda in general and Mbale in particular has people of diverse culture, religion and ethnic background as well as diverse socio economic activities with various practices. This multi-cultural environment creates differences in perception

of information and practices. Most cultures encourage socialisation through social functions like attending weddings, funerals, work places and gatherings and Muslims who have to go for congregation prayers in the mosques 5 times a day among others. This puts such communities at risk of spreading the disease very fast and slow in adapting to control measures

AIM: In this study, we aimed at assessing knowledge and practices of the community towards COVID 19 in Mbale municipality.

METHODS AND MATERIALS: A cross section study was used; Data was obtained using a Questionnaire to a sample of 355 respondents and an observation tool was also used to observe behaviour patterns and practices of 776 participants towards the control measures of COVID-19.

RESULTS: There was a total of 355 respondents with 208 /355 (58.59%) male and 147/355 (41.4%) female. 149/355(42%) possessed good knowledge, 131/355(36.9%) had moderate knowledge and 75/355(21%) had a little knowledge on COVID-19. Participants who were single and aged between 21-30 years were found to be more knowledgeable than other groups (P value=.001 and P value=.003 respectively). The source of COVID 19 information was mainly from television and radios 124/248 (50%) and social media 34/248 (21.8%) and the least source of information being 14/248(5.6%) and 9/248(3.6%) from health workers and Religious leaders respectively. 496/776 (64%) of the respondents observed, washed their hands and only124/776 (16%) of the respondents wore face masks. 98/776 (12.6%) were seen shaking hands and 15/776(2%) were seen hugging.

CONCLUSION: Use of appropriate and well-designed Health education materials on radios, televisions and social media platforms like Facebook and twitter among others can be effective means of communication since they can reach the highest number of people. Ministry of Health should design ways for systematically integrating both political and religious leaders in Health Education Campaigns. Government should provide facemasks and enforce their use. A study to assess the ability of both political and religious leaders in health promotion campaigns should be carried out.

3. COVID-19 may exacerbate the clinical, structural and psychological barriers to retention in care among women living with HIV in rural and peri-urban settings in Uganda

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ABSTRACT

BACKGROUND: Retention of pregnant and breastfeeding women and their infants in HIV care still remains low in Uganda. Recent literature has shown that the effects of COVID-19 mitigation measures may increase disease burden of common illnesses including HIV, Tuberculosis, Malaria and other key public health outcomes such as maternal mortality. A research program was undertaken to locate disengaged HIV positive women on option B+ and supported them to reengage in care. A 1 year follow up done following the tracing revealed that some women still disengaged from care. We aimed to establish the barriers to and facilitators for reengagement in care among previously traced women on option B+, and how these could have been impacted by the COVID-19 pandemic.

METHODS: This was a cross sectional qualitative study using individual interviews conducted in June and July 2020, a period when the COVID-19 response measures such as lockdown and restrictions on transport were being observed in Uganda. Study participants were drawn from nine peri-urban and rural public healthcare facilities. Purposive sampling was used to select women still engaged in and those who disengaged from care approximately after 1 year since they were last contacted. Seventeen participants were included. Data was analysed using the content analysis approach.

RESULTS: Women reported various barriers that affected their reengagement and retention in care during the COVID-19 pandemic. These included structural barriers such as transport difficulties and financial constraints; clinical barriers which included unsupportive healthcare workers, short supply of drugs, clinic delays, lack of privacy and medicine side effects; and psychosocial barriers such as perceived or experienced stigma and non-disclosure of HIV sero-status. Supportive structures such as family, community-based medicine distribution models, and a friendly healthcare environment were key facilitators to retention in care among this group. The COVID-19 pandemic was reported to exacerbate the barriers to retention in care.

CONCLUSIONS: COVID-19 may exacerbate barriers to retention in HIV care among those who have experienced previous disengagement. We recommend community-based models such as drop out centres, peer facilitated distribution and community outreaches as alternative measures for access to ART during the COVID-19 pandemic.

Keywords: Retention, Women, COVID-19, Uganda, Barriers, HIV care

4. Prevalence and predictors of burnout among nurses during COVID-19: a cross-sectional study in hospitals in central Uganda

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ABSTRACT

OBJECTIVE: To determine the prevalence of burnout and associated factors among nurses during COVID-19 in central Uganda.

DESIGN: A cross-sectional design. Setting Nurse from one referral and four general hospitals. These were reception centres and cared for patients with COVID-19 in central Uganda. Participants 395 nurses. Main outcome measures Burnout scores.

RESULTS: Of the total 395 participants, 65.1% (n=257) were female; 40% (n=158) had a diploma; 47.1% (n=186) were single; and 39.2% (n=155) had worked for 11–15 years. The results show that 40% (n=158), 41.77% (n=165) and 18.23% (n=77) reported high, average and low levels of burnout, respectively. The results show that the predictors of nurses' burnout were personal protective equipment (PPE) (OR: 7.1, 95% CI 4.08 to 12.31) and increased workload (OR 4.3, 95% CI 2.43 to 7.93).

CONCLUSION: This study of nurses working in hospitals dealing with patients with COVID-19 in central Uganda reported high rates of burnout, and it was associated with PPE and workload. Interventions like contracting new nurses to reduce workload, the WHO guidelines on PPE, adjusting working hours and ensuring hours of effective rest should be adapted.

5. Increased Depression during COVID-19 Lockdown Associated with Food Insecurity and Antiretroviral Non-Adherence among People Living with HIV in Uganda

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ABSTRACT

The health and economic threats posed by the COVID-19 pandemic can be sources of great distress among people living with HIV, which in turn can impact the management of their HIV disease. We examined change in depression from pre- to post-lockdown restrictions and correlates of elevated depressive symptoms, including antiretroviral therapy (ART) adherence. Participants enrolled in a randomized controlled trial of an ART adherence intervention in Uganda. The month-12 follow-up assessment was fully administered just prior to the start of the pandemic-related lockdown in March 2020; at the conclusion of the lockdown three months later, we administered a mixed-methods phone-based assessment. ART adherence was electronically monitored throughout the study period, including during and after the lockdown. Depression was assessed with the 8-item Patient health questionnaire (PHQ-8), on which scores >9 signify a positive screen for elevated depressive symptoms. A sample of 280 participants completed both

the month-12 and post-lockdown assessments. Rates of elevated depressive symptoms nearly tripled from month 12 (n=17, 6.1%) to the post-lockdown assessment (n=50, 17.9%; McNemar test <.001). Elevated depressive symptoms at post-lockdown were associated with being female, indicators of economic struggles at month 12 (unemployment, low income, high food insecurity), and lower ART adherence during the 3-month lockdown period [mean of 71.9% (SD=27.9) vs. 80.8% (SD=24.1) among those not depressed; p=.041] in bivariate analysis. In multiple regression analysis, higher food insecurity [adj. OR (95% CI) =4.64 (2.16–9.96)] and perception that the pandemic negatively impacted ART adherence [adj. OR (95% CI)=1.96 (1.22–3.16)] remained associated with a greater likelihood of elevated depressive symptoms, when other correlates were controlled for. Qualitative data suggested that economic stressors (lack of food, work, and money) were key contributors to elevated depressive symptoms, and these stressors led to missed ART doses because of lack of food and stress induced forgetfulness. Elevated depressive symptoms significantly increased during the COVID-19 lockdown and was associated with food insecurity and reduced ART adherence. Mechanisms for identifying and treating depression and food insecurity are needed to help PLHIV cope with and mitigate the harmful effects of unexpected crises that may impede disease management and access to food.

Keywords: Depression, COVID-19, Adherence, HIV, Economic, Food insecurity, Uganda

6. Treatment of COVID-19 with Herbal Medicines: Perceptions, Attitudes and Practices of Healthcare Professionals Students in Uganda

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ABSTRACT

BACKGROUND: Use of herbal medicine (HM) for the treatment and prevention of the coronavirus disease -2019 (COVID19) has been reported worldwide. In this study, we aimed to assess the perceptions, attitude and practices of healthcare professionals (HP) students in Uganda concerning HM use in the management of COVID-19 illness.

METHODS: We conducted an online, cross-sectional study using quantitative methods among HP students across the 12 medical schools in Uganda. Undergraduate HP students aged 18

years and older, from 1st to 5th year of study, pursuing various programs were recruited. Blooms cut-off of 80% (score of $\geq 24/30$) was used to determine good perception and a positive attitude towards HM use. Logistic regression analysis was performed to determine factors associated with HM use.

RESULTS: A total of 350 participants responded. Of this, 223 (63.7%) were male. The median age of all participants was 23 (IQR=19-56) years. Majority (n=234, 66.9%) were pursuing Bachelor of Medicine and Bachelor of Surgery (MBChB). All participants reported awareness on HM use in the management of COVID-19. Fifty-four (15.4%) respondents had a good perception towards HM use, with students in their first year of study having 3-fold the odds of having good perception compared to those in their fifth year (aOR: 2.9, 95% C. I: 1.1-8.1, p=0.037). Participants pursuing Bachelor of Pharmacy (BPHAR) had 4.2-fold higher odds of having a positive attitude towards HM use compared to those pursuing MBChB (aOR: 4.2, 95% CI:1.8-9.9, p=0.001) and those in first year had 2.7-fold higher odds of having a positive attitude towards HM use compared to participants in fifth year of study. (aOR=2.7, 95% CI=1.2-6.3, p=0.019). Participants with positive attitude towards HM use (aOR=63.7, 95% CI=12.8-316.4, p<0.001), pharmacy students (aOR=2.6, 95% CI= 1.1-6.4, p=0.035), allied health program students (aOR=3.6, 95% CI=1.1-11.6, p=0.032), those with good perception (aOR=3.3, 95% CI=1.6-6.5, p<0.001) and positive attitude (aOR=2.7, 95% CI=1.2-5.9, p=0.013) were more likely to recommend use of HM in the management of COVID-19.

CONCLUSION: Awareness of HM use was universal among the participants. However, despite a high proportion of the participants reporting negative perception and attitude towards HM use, at least one-third use HM when they had COVID-19.

Keywords: Herbal medicine, COVID-19, Treatment, Healthcare, Students, Uganda.

7. Beyond “carrots” and “sticks” of on-line learning during the COVID-19 pandemic: A Case of Uganda Martyrs University

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ABSTRACT

Listening and appreciating the views of the academic staff and students is critical in a learning period characterised by abrupt changes in the mode of classroom delivery where the traditional classroom teaching and learning is replaced by virtual classes. This study explored the “carrots” and “sticks” of on-line learning experienced by both academic staff and students at Uganda Martyrs University in Uganda. The study used a qualitative research approach involving in-depth interviews for academic staff and focus groups with selected university students from three academic Faculties. The study results showed that both students and academic staff found on-line learning beneficial in terms of incurring reduced transport expenses and chances of getting infected with COVID-19 due to reduced physical mobility. Due to increased use of technologies, the participants became more innovative and conscious in time use during the teaching-learning

process. However, the effectiveness of on-line learning was limited by the challenges of limited data, unreliable internet connection, failure to record lectures, few zoom links at Faculty level, limited class control, and unstable attendance by students. Results further revealed the challenges of time constraint for computational subjects, assessment challenge, limited skills and knowledge in using, limited consultations, and speedy lecturers. The results provide valuable information on the progress in adjusting to the demands of the “new normal” in higher education teaching and learning. Concerted efforts of institutional leadership, academic staff and students should be the norm especially in acquiring and using ICT Infrastructure to enable academic staff and students’ transit to the “new normal”.

Keywords: Carrot and stick, online learning, COVID 19 pandemic, physical mobility, teaching learning process, new normal.

8. Drivers affecting the acceptance and use of Electronic Learning among Ugandan University students in the COVID-19 era. A cross-sectional survey among three universities.

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ABSTRACT

COVID-19 is an emerging and highly infectious disease that is becoming a global health challenge affecting all sectors. To prevent COVID-19 transmission, all education institutions were closed and advised to turn to online learning. The present study sought to determine the factors affecting the acceptance and use of electronic learning among Ugandan University students in three universities. The study relied on two data collection instruments: a questionnaire and a semi-structured interview. An online cross-sectional survey was conducted on a population of students in three pre-selected universities: Kyambogo (KYU), Makerere (MAK), and Kampala International University (KIU). Of the 614 questionnaires returned, 578 were valid; 65.4% of the respondents were males; 60.7% were from MAK and the majority being in their third year of study (49%). Overall, 69.2% had good knowledge, 22.5% had positive attitudes toward e-learning. The semi-structured interviews revealed connectivity and skills challenges as the main barriers to the implementation of e-learning. For better implementation of e-learning by Universities, effective planning needs to be done with active students’ involvement to avert negative attitudes. We recommend more studies be done on the Universities’ preparedness for the implementation of e-learning. Universities should collaborate with telecommunication companies to provide subsidized prices for internet costs and information and communications technology (ICT) equipment to students.

Keywords: e-learning, ICT, COVID-19, knowledge, attitudes

9. Severe COVID-19 in Uganda across Two Epidemic Phases: A Prospective Cohort Study

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ABSTRACT.

Among a prospective cohort of children and adults admitted to a national COVID-19 treatment unit in Uganda from March to December 2020, we characterized the epidemiology of and risk factors for severe illness. Across two epidemic phases differentiated by varying levels of community transmission, the proportion of patients admitted with WHO-defined severe COVID-19 ranged from 5% (7/146; 95% CI: 2–10) to 33% (41/124; 95% CI: 25–42); 21% (26/124; 95% CI: 14–29%) of patients admitted during the peak phase received oxygen therapy. Severe COVID-19 was associated with older age, male sex, and longer duration of illness before admission. Coinfection with HIV was not associated with illness severity; malaria or tuberculosis coinfection was rare. No patients died during admission. Despite low mortality, hospital incidence of severe COVID-19 during the first epidemic peak in Uganda was substantial. Improvements in vaccine deployment and acute care capacity, including oxygen delivery, are urgently needed to prevent and manage severe COVID-19 in sub-Saharan Africa.

10. Impact of COVID-19 on routine malaria indicators in Uganda: An interrupted time series analysis

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ABSTRACT

BACKGROUND: In March 2020, the government of Uganda implemented a strict lockdown policy in response to the COVID-19 pandemic. We performed an interrupted time series analysis (ITSA) to assess whether major changes in healthcare seeking behavior, malaria burden, and case management occurred after the onset of the COVID-19 epidemic.

METHODS: Individual level data from all outpatient visits occurring from April 2017 through March 2021 at 17 facilities were analyzed. Outcomes included total outpatient visits, malaria cases, non-malarial visits, proportion of visits with suspected malaria, proportion of patients tested using rapid diagnostic tests (RDTs), and proportion of malaria cases prescribed artemether-lumefantrine (AL). Pre-COVID trends measured over a three-year period were extrapolated into the post-COVID period (April 2020- March 2021) using Poisson regression with generalized estimating equations or fractional regression. Effects of COVID-19 were estimated over the 12-month post-COVID period by dividing observed values by the predicted values and expressed as ratios.

RESULTS: A total of 1,442,737 outpatient visits were recorded. Malaria was suspected in 55.3% of visits and 98.8% of these had a malaria diagnostic test performed. ITSA showed no differences in the observed versus predicted total outpatient visits, malaria cases, non-malarial visits, or proportion of visits with suspected malaria. However, in the second six months of the post-COVID period, there was a smaller mean proportion of patients tested with RDTs compared to predicted (Relative Prevalence Ratio (RPR) = 0.87, CI [0.78, 0.97]) and a smaller mean proportion of malaria cases prescribed AL (RPR = 0.94, CI [0.90, 0.99]).

CONCLUSIONS: There was evidence for a modest decrease in the proportion of RDTs used for malaria diagnosis and the proportion of patients prescribed AL in the second half of the post-COVID year, while other malaria indicators remained stable. Continued surveillance will be essential to monitor for changes in trends in malaria indicators so that Uganda can quickly and flexibly respond to challenges imposed by COVID-19.

Keywords: Infectious Diseases, COVID-19 pandemic, ITSA, Pre-COVID, rapid diagnostic tests (RDTs)

11. Health facilities' readiness for safe surgical care provision in Uganda and the Eastern Democratic Republic of Congo during Ebola and COVID-19 era

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ABSTRACT

OBJECTIVE: This study aimed to assess health facilities' readiness to provide safe surgical care during Ebola and COVID-19 era in Uganda and in the Eastern DR Congo.

METHODS: A cross-sectional study was conducted in selected national, regional referral and general hospital facilities in Uganda and in the eastern part of DR Congo from 1st August 2020 to 30th October 2020. Data was analysed using Stata version 15.

RESULTS: The participation rate was of 37.5 % (72/192) for both countries. None of the hospitals fulfilled the readiness criteria for safe surgical care provision in both countries. The mean bed capacity of participating health facilities (HF) was 184 in Eastern DR Congo and 274 in Uganda with an average surgical ward bed capacity of 22.3 % (41/184) and 20.4 % (56/274) respectively. The mean number of operating rooms was 2 and 3 in Eastern DR Congo and Uganda respectively. Nine hospitals (12.5 %) reported being able to test for Ebola and 25 (34.7 %) being able to test for COVID-19. Postponing of elective surgeries was reported by 10 (13.9) participating hospitals. Only 7 (9.7 %) hospitals reported having a specific operating room for suspect or confirmed cases of Ebola or COVID-19. Appropriate Personal Protection Equipment (PPE) was reported to be available in 60 (83.3 %) hospitals. Most of the staff had appropriate training on donning and doffing of PPE 40 (55.6 %). Specific teams and protocols for safe surgical care

provision were reported to be present in 61 (84.7 %) and 56 (77.8 %) respectively in Uganda and Eastern DR Congo participating hospitals.

CONCLUSIONS: The lack of readiness to provide safe surgical care during Ebola and COVID-19 era across the participating hospitals in both countries indicate a need for strategies to enhance health facility supplies and readiness for safe surgical provision in resource-limited settings.

Keywords: Health facilities, Safe surgical care provision, Readiness, Ebola, COVID-19

12. Efficacy of convalescent plasma for treatment of COVID-19 in Uganda

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ABSTRACT

RATIONALE: Convalescent plasma (CCP) has been studied as a potential therapy for COVID-19, but data on its efficacy in Africa are limited.

OBJECTIVE: In this trial we set out to determine the efficacy of CCP for treatment of COVID-19 in Uganda.

MEASUREMENTS: Patients with a positive SARS-CoV-2 reverse transcriptase (RT)-PCR test irrespective of disease severity were hospitalised and randomised to receive either COVID-19 CCP plus standard of care (SOC) or SOC alone. The primary outcome was time to viral clearance, defined as having two consecutive RT-PCR-negative tests by day 28. Secondary outcomes included time to symptom resolution, clinical status on the modified WHO Ordinal Clinical Scale (≥ 1 -point increase), progression to severe/critical condition (defined as oxygen saturation $< 93\%$ or needing oxygen), mortality and safety.

MAIN RESULTS: A total of 136 patients were randomised, 69 to CCP+SOC and 67 to SOC only. The median age was 50 years (IQR: 38.5–62.0), 71.3% were male and the median duration of symptom was 7 days (IQR=4–8). Time to viral clearance was not different between the CCP+SOC and SOC arms (median of 6 days (IQR=4–11) vs 4 (IQR=4–6), $p=0.196$). There were no statistically significant differences in secondary outcomes in CCP+SOC versus SOC: time to symptom resolution (median=7 (IQR=5–7) vs 7 (IQR=5–10) days, $p=0.450$), disease progression (9 (22.0%) vs 7 (24.0%) patients, $p=0.830$) and mortality (10 (14.5%) vs 8 (11.9%) deaths, $p=0.476$).

CONCLUSION: In this African trial, CCP therapy did not result in beneficial virological or clinical improvements. Further trials are needed to determine subgroups of patients who may benefit from CCP in Africa.

13. Indirect effects of COVID-19 on maternal, neonatal, child, sexual and reproductive health services in Kampala, Uganda

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ABSTRACT

BACKGROUND: COVID-19 impacted global maternal, neonatal and child health outcomes. We hypothesised that the early, strict lockdown that restricted individuals' movements in Uganda limited access to services.

METHODS: An observational study, using routinely collected data from Electronic Medical Records, was carried out, in Kawempe district, Kampala. An interrupted time series analysis assessed the impact on maternal, neonatal, child, sexual and reproductive health services from July 2019 to December 2020. Descriptive statistics summarised the main outcomes before (July 2019–March 2020), during (April 2020–June 2020) and after the national lockdown (July 2020–December 2020).

RESULTS: Between 1 July 2019 and 31 December 2020, there were 14 401 antenatal clinic, 33 499 deliveries, 111 658 childhood service and 57 174 sexual health attendances. All antenatal and vaccination services ceased in lockdown for 4 weeks. During the 3-month lockdown, the number of antenatal attendances significantly decreased and remain below pre-COVID levels (370 fewer/month). Attendances for prevention of mother-to-child transmission of HIV dropped then stabilised. Increases during lockdown and immediately post lockdown included the number of women treated for high blood pressure, eclampsia and pre-eclampsia (218 more/month), adverse pregnancy outcomes (stillbirths, low-birth-weight and premature infant births), the rate of neonatal unit admissions, neonatal deaths and abortions. Maternal mortality remained stable. Immunisation clinic attendance declined while neonatal death rate rose (from 39 to 49/1000 livebirths). The number of children treated for pneumonia, diarrhoea and malaria decreased during lockdown.

CONCLUSION: The Ugandan response to COVID-19 negatively impacted maternal, child and neonatal health, with an increase seen in pregnancy complications and fetal and infant outcomes, likely due to delayed care-seeking behaviour. Decreased vaccination clinic attendance leaves a cohort of infants unprotected, affecting all vaccinepreventable diseases. Future pandemic responses must consider impacts of movement restrictions and access to preventative services to protect maternal and child health.

14. Exploring health workers' experiences of mental health challenges during care of patients with COVID-19 in Uganda: a qualitative study

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ABSTRACT

OBJECTIVES: The aim of this study is to qualitatively investigate the lived experiences of mental health among front-line health workers providing COVID-19-related care in Uganda. This study provides insights into the contextual realities of the mental health of health workers facing greater challenges given the lack of adequate resources, facilities and health workers to meet the demand brought about by COVID-19.

RESULTS: All in all, our findings suggest that healthcare workers are under enormous stress during this pandemic, however, in order to effectively respond to the COVID-19 pandemic in Uganda, it is important to understand their challenges and sources of these challenges. The government thus has the reasonability to address most of the sources that were highlighted (long working hours, lack of proper equipment, lack of sleep, exhaustion, and experiencing high death rate under their care). Further, the Ugandan social fabric presents an opportunity for coping through its strong communal links and networks. Scaling these forms of local responses is cheap but contextually useful for a country with limited resources like Uganda.

Keywords: Healthcare workers, Mental health, COVID-19.

15. Face mask use and associated factors among students in rural Eastern Uganda amidst the COVID-19 pandemic

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ABSTRACT

BACKGROUND: The Corona Virus Disease of 2019 (COVID-19) has gravely affected several aspects of national and global society, including education. Given the risk it poses, the Government of Uganda (GOU) adopted and recommended facemask use as one of the preventive measures to limit its transmission in communities. However, there is limited data on the levels of facemask usage and associated factors among students in schools in Uganda. This study aimed at assessing the facemask usage and associated factors among students in schools in rural Eastern Uganda amidst the COVID-19 pandemic.

METHODS: A cross sectional quantitative descriptive study was conducted among 423 students in schools in rural Eastern Uganda. Multi-stage sampling method was employed in the selection of study participants. The data was collected by trained data collectors using structured questionnaires pre-installed on ODK enabled smart phones. The data entered was cleaned using

Excel 2016 and exported to Stata14.0 statistical software (Statacorp, College station, Texas, USA) for analysis. Bivariate and multivariable logistic regression analyses were employed using 95% CI (confidence interval). Variables with p-value < 0.20 and those with literature backup evidence were included in the multivariable model. Variables with p-value < 0.05 were considered to be statistically significant. This study revealed that less than three quarters (62.3%) wore facemasks correctly.

RESULTS: Almost all, 98.9% of the participants mentioned that they wore face masks due to fear of missing classes and 49.0% disagreed that they were vulnerable to COVID-19. Students in boarding schools (AOR = 1.61, 95%CI: 1.05-2.47), those who believed that they were vulnerable to COVID-19 (AOR = 1.70, 95%CI: 1.11-2.10), and those who disagreed that masks are uncomfortable (AOR = 1.62, 95%CI: 1.06-2.46) were more likely to wear facemasks correctly.

CONCLUSION: This study revealed that more than a third of the students did not wear facemasks correctly. Correct wearing of facemasks was associated with being in a boarding school, belief that they were susceptible to COVID-19, and disagreeing that masks were uncomfortable. This therefore highlights the need for sensitization programmes in academic institutions in order to improve students' perceptions toward COVID-19 and facemasks, and consequently increase correct facemask usage in schools.

16. “A Double Stress”: The Mental Health Impacts of the COVID-19 Pandemic Among People Living with HIV in Rakai, Uganda

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AIDS and Behavior <https://doi.org/10.1007/s10461-021-03379-6> Published: 22 July 2021

ABSTRACT

Mental health impacts of the COVID-19 pandemic for people living with HIV are poorly understood, especially in low-income settings. We conducted qualitative semi-structured in-depth interviews among people living with HIV (n=16) and health workers (n=10) in rural Rakai, southcentral Uganda. Data were analyzed thematically. We found mental stress during COVID-19 was compounded by worry about antiretroviral therapy (ART) access, distress over inadvertent disclosure of HIV status, fear that coronavirus infection would have more severe outcomes for immunocompromised individuals, and exacerbated poverty and economic stress. Mental health support for people living with HIV deserves greater attention during the COVID-19 pandemic and beyond.

Keywords: Mental health, COVID-19, HIV, Distress

17. The effectiveness of a psycho-education intervention on mental health literacy in communities affected by the COVID-19 pandemic—a cluster randomized trial of 24 villages in central Uganda—a research protocol

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ABSTRACT

BACKGROUND: Literature shows a high prevalence of psychological distress (PD) as well as common mental disorders (CMD) such as major depressive disorders (MDD), generalized anxiety disorders (GAD), post-traumatic stress disorders (PTSD), and substance misuse disorders (SUD) among people exposed to disasters and pandemics like the COVID-19. Moreover, CMD are associated with increased mortality (mainly through suicide) and morbidity (loss of productivity). A number of countries have made deliberate efforts to identify and manage CMD in light of COVID-19. However, low levels of mental health literacy (MHL) manifested by the individual's unawareness of CMD symptoms, limited human and mental health infrastructure resources, and high levels of mental illness stigma (MIS) are barriers to integration of mental health care in general health care during pandemics and epidemics such as the COVID-19.

OBJECTIVES: For the proposed study, we will determine effectiveness of a psycho-education intervention delivered by village health team (VHT) members.

METHODS: We will employ a cluster randomized trial design in 24 villages in central Uganda. We will collect baseline data to and document the prevalence of MHL, PD, MDD, PTSD, GAD, and SUD. We will distribute information education and communication materials (IEC) aimed at improving MHL to 420 adult individuals in the intervention arm (n = 12 villages). In the control arm (n = 12 villages), VHTs will distribute ministry of health COVID19 information leaflets to 420 participants. Within 7 days of distributing the materials, research assistants will conduct a follow-up interview and assess for the same parameters (MHL, PD, MDD, PTSD, GAD, and SUD). We will use an intention to treat analysis to estimate the effectiveness of the psycho-education intervention.

18. Dispensing antiretrovirals during Covid-19 lockdown: re-discovering community-based ART delivery models in Uganda

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ABSTRACT

BACKGROUND: The notion of health-system resilience has received little empirical attention in the current literature on the Covid-19 response. We set out to explore health-system resilience at the sub-national level in Uganda with regard to strategies for dispensing antiretrovirals during Covid-19 lockdown.

METHODS: We conducted a qualitative case-study of eight districts purposively selected from Eastern and Western Uganda. Between June and September 2020, we conducted qualitative interviews with district health team leaders (n = 9), ART clinic managers (n = 36), representatives of PEPFAR implementing organizations (n = 6). In addition, six focus group discussions were held with recipients of HIV care (48 participants). Qualitative data were analyzed using thematic approach.

RESULTS: Five broad strategies for distributing antiretrovirals during 'lockdown' emerged in our analysis: accelerating home-based delivery of antiretrovirals; extending multi-month dispensing from three to six months for stable patients; leveraging the Community Drug Distribution Points (CDDPs) model for ART refill pick-ups at outreach sites in the community; increasing reliance on health information systems, including geospatial technologies, to support ART refill distribution in unmapped rural settings. District health teams reported leveraging Covid-19 outbreak response funding to deliver ART refills to homesteads in rural communities.

CONCLUSION: While Covid-19 'lockdown' restrictions undoubtedly impeded access to facility-based HIV services, they revived interest by providers and demand by patients for community-based ART delivery models in case-study districts in Uganda.

19. The impact of COVID-19 on industries without smokestacks in Uganda

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ABSTRACT

In Uganda, the spread of COVID-19 and its economic impacts gained momentum in March 2020 when the country's first case was reported. By March 30, the government of Uganda had declared a nation-wide lockdown in addition to other critical measures to minimize its spread. The impacts of the virus itself together with government initiatives to control its spread have been felt in the political, social, and economic spheres of life of the country. Simply put, there have been losers and winners as the pandemic took its toll on the economy. This brief examines the potential economic impact of COVID-19 on Uganda's industries without smokestacks as a follow-up on the previous work undertaken in the same sectors prior to the pandemic. The aim is to ascertain whether the recommendations made prior to the pandemic are still relevant.

20. Repercussions of the COVID-19 Response in Pregnant Women in Western Uganda: Knowledge, Behavior, and Emotional State after the First Lockdown in 2020

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ABSTRACT:

Limited research exists on pregnant women's knowledge, attitudes, and behavior concerning COVID-19 in sub-Saharan Africa. We performed a cross-sectional study among 648 pregnant women in Fort Portal, Uganda, after the first lockdown starting in June 2020. Structured interviews were conducted at three different facilities during routine antenatal care, assessing sociodemographic background, knowledge of COVID-19, prevention behavior adherence, and psycho-emotional stress levels. We performed descriptive analyses and examined associated factors using multivariable logistic regression. In Fort Portal Region, 32.8% of pregnant women had a higher knowledge regarding the COVID-19 pandemic, while all women at least heard of COVID-19. 88.6% of the women showed low self-reported prevention behavior adherence. More than one third of the pregnant women experienced high psycho-emotional stress related to the pandemic (39.8%). The odds for psycho-emotional stress were increased among the age group 21–30 years (AOR 1.97; 95% CI 1.18– 3.35) compared to women under the age of 21, and

decreased in single or divorced women compared to women in partnerships (AOR 0.42; 0.22–0.77) and in women having less COVID-19-related knowledge (AOR 0.40; 0.27–0.58). In conclusion, prevention behavior adherence seemed challenging, and psycho-emotional stress was ubiquitous among our cohort. To avoid adverse consequences in maternal and neonatal health, campaigns for hygiene but also women's emotional state should be a major focus of community healthcare in exceptional times such as the SARS-CoV-2 pandemic.

Keywords: Uganda; COVID-19; KAP study; knowledge; prevention behavior; emotional stress; pregnant women.

21. Sociodemographic factors associated with acceptance of COVID-19 vaccine and clinical trials in Uganda: a cross-sectional study in western Uganda

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ABSTRACT

BACKGROUND: Health experts agree that widespread use of safe and effective vaccines will rapidly contain the COVID-19 pandemic. The big question is whether these vaccines can easily be accepted by their end-users. Our study aimed at determining sociodemographic factors associated with acceptance of vaccines and clinical trials of COVID-19 in western Uganda.

METHOD: A simplified snowball sampling technique was used to select 1067 respondents of 18–70 years in western Uganda using an online questionnaire from July to September 2020. Vaccine acceptability and risk perception were assessed using odds ratio at 95% confidence interval in R software version 3.6.3.

RESULTS: There were 1067 participants in the study. The majority were males (73.2%) and age group 31–40 years (32.6%). The acceptance rate for COVID-19 vaccination was (53.6%; 572/1067) with those aged 18–20 years, males, elites at tertiary level of education (degree or diploma), students, Muslims, married, non-salary earners and rural dwellers having better odds and likeliness to accept vaccination. Only 44.6% (476/1067) showed interest in clinical trials among which; males, primary school leavers, students, Christians, un-married, respondents who didn't earn any salary and rural dwellers had better odds and likelihood to participate in clinical trials.

CONCLUSION: There was a low level of vaccine acceptance and clinical trial interest in western Uganda. Minority groups in the study i.e., Muslims, students, primary school leavers, un-married rural dwellers among others showed more interest in vaccination and clinical trials. We anticipated fears in the larger part of this community that health experts need to address through reassurance of the community that vaccines are tested and that they are safe and important if we are to rapidly contain the COVID-19 pandemic.

Keywords: COVID-19, vaccine, Acceptance, Clinical trials, Western Uganda.

22. Feasibility of collecting and processing of COVID-19 convalescent plasma for treatment of COVID-19 in Uganda

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ABSTRACT

INTRODUCTION: Evidence that supports the use of COVID-19 convalescent plasma (CCP) for treatment of COVID-19 is increasingly emerging. However, very few African countries have undertaken the collection and processing of CCP. The aim of this study was to assess the feasibility of collecting and processing of CCP, in preparation for a randomized clinical trial of CCP for treatment of COVID-19 in Uganda.

METHODS: In a cross-sectional study, persons with documented evidence of recovery from COVID-19 in Uganda were contacted and screened for blood donation via telephone calls. Those found eligible were asked to come to the blood donation centre for further screening and consent. Whole blood collection was undertaken from which plasma was processed. Plasma was tested for transfusion transmissible infections (TTIs) and anti-SARS CoV-2 antibody titers. SARS-CoV-2 testing was also done on nasopharyngeal swabs from the donors.

RESULTS: 192 participants were contacted of whom 179 (93.2%) were eligible to donate. Of the 179 eligible, 23 (12.8%) were not willing to donate and reasons given included: having no time (30.4%), fear of being retained at the COVID-19 treatment center 10 (43.5%), fear of stigma in the community 1 (4.3%), phobia for donating blood 1 (4.3%), religious issues 1 (4.4%), lack of interest 2 (8.7%) and transport challenges 1 (4.3%). The median age was 30 years and females accounted for 3.7% of the donors. A total of 30 (18.5%) donors tested positive for different TTIs. Antibody titer testing demonstrated titers of more than 1:320 for all the 72 samples tested. Age greater than 46 years and female gender were associated with higher titers though not statistically significant.

CONCLUSION: CCP collection and processing is possible in Uganda. However, concerns about stigma and lack of time, interest or transport need to be addressed in order to maximize donations.

23. COVID-19 vaccine acceptance among high-risk populations in Uganda

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ABSTRACT

BACKGROUND: Immunization is an important strategy for controlling the COVID-19 pandemic. COVID-19 vaccination was recently launched in Uganda, with prioritization to healthcare workers

and high-risk individuals. In this study, we aimed to determine the acceptability of COVID-19 vaccine among persons at high risk of COVID-19 morbidity and mortality in Uganda.

METHODS: Between 29 March and 14 April 2021, we conducted a cross-sectional survey consecutively recruiting persons at high risk of severe COVID-19 (diabetes mellitus, HIV and cardiovascular disease) attending Kiruddu National Referral Hospital outpatient clinics. A trained research nurse administered a semi-structured questionnaire assessing demographics, COVID-19 vaccine related attitudes and acceptability. Descriptive statistics, bivariate and multivariable analyses were performed using STATA 16.

RESULTS: A total of 317 participants with a mean age 51.5 ± 14.1 years were recruited. Of this, 184 (60.5%) were female. Overall, 216 (70.1%) participants were willing to accept the COVID-19 vaccine. The odds of willingness to accept COVID-19 vaccination were four times greater if a participant was male compared with if a participant was female [adjusted odds ratio (AOR): 4.1, 95% confidence interval (CI): 1.8–9.4, $p=0.00$]. Participants who agreed (AOR: 0.04, 95% CI: 0.01–0.38, $p=0.003$) or strongly agreed (AOR: 0.04, 95% CI: 0.01–0.59, $p=0.005$) that they have some immunity against COVID-19 were also significantly less likely to accept the vaccine. Participants who had a history of vaccination hesitancy for their children were also significantly less likely to accept the COVID-19 vaccine (AOR: 0.1, 95% CI: 0.01–0.58, $p=0.016$).

CONCLUSION: The willingness to receive a COVID-19 vaccine in this group of high-risk individuals was comparable to the global COVID-19 vaccine acceptance rate. Increased sensitization, myth busting and utilization of opinion leaders to encourage vaccine acceptability is recommended.

Keywords: COVID-19, high-risk population, Uganda, vaccines.

24. Effectiveness of thermal screening in detection of COVID-19 among truck drivers at Mutukula Land Point of Entry, Uganda

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ABSTRACT

INTRODUCTION: Despite the limited evidence for its effectiveness, thermal screening at points of entry has increasingly become a standard protocol in numerous parts of the globe in response to the COVID-19 pandemic. We sought to determine the effectiveness of thermal screening as a key step in diagnosing COVID-19 in a resource-limited setting.

MATERIALS AND METHODS: This was a retrospective cross-sectional study based on a review of body temperature and Xpert Xpress SARS CoV-2 test results records for truck drivers entering Uganda through Mutukula between 15th May and 30th July 2020. All records missing information for body temperature, age, gender, and Xpert Xpress SARS CoV-2 status were excluded from the data set. A data set of 7,181 entries was used to compare thermal screening and Xpert Xpress SARS CoV-2 assay test results using the diagnostic statistical test in STATAv15 software. The prevalence of COVID-19 amongst the truck drivers based on Xpert Xpress SARS CoV-2 assay results was determined. The sensitivity, specificity, positive predictive value, negative predictive value, positive and negative Likelihood ratios were obtained using Xpert Xpress SARS CoV-2 assay as the gold standard.

RESULTS: Based on our gold standard test, the proportion of persons that tested positive for COVID-19 was 6.7% (95% CI: 6.1–7.3). Of the 7,181 persons that were thermally screened, 6,844 (95.3%) were male. The sample median age was 38 years (interquartile range, IQR: 31–45 years). The median body temperature was 36.5°C (IQR: 36.3–36.7) and only n (1.2%) had a body temperature above 37.5°C. The sensitivity and specificity of thermal screening were 9.9% (95% CI: 7.4–13.0) and 99.5% (95% CI: 99.3–99.6) respectively. The positive and negative predictive values were 57.8 (95% CI: 46.5–68.6) and 93.9 (95% CI: 93.3–94.4) respectively. The positive and negative Likelihood Ratios (LRs) were 19 (95% CI: 12.4–29.1) and 0.9 (95% CI: 0.88–0.93) respectively.

CONCLUSION: In this study population, the use of Thermal screening alone is ineffective in the detection of potential COVID-19 cases at point of entry. We recommend a combination of screening tests or additional testing using highly sensitive molecular diagnostics such as Polymerase Chain Reaction.

25. Managing enduring public health emergencies such as COVID-19: lessons from Uganda Red Cross Society's Ebola virus disease response operation

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ABSTRACT

BACKGROUND: In this piece, we translate insights from our study of routine coordination in the Ebola virus disease response operation by Uganda Red Cross Society (URCS) for managing long-lasting public health emergencies. We further show how these lessons are relevant to the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic. Commonly, emergency response organisations, like the URCS or hospitals, are ill equipped to handle longer lasting emergencies. These emergencies require special measures that combine ad-hoc action, continuous awareness over longer time periods, and the collaboration of multiple actors such as the government, public health institutions and other non-governmental organisations (NGOs).

RESULTS: From our study we can translate seven lessons learnt which are important for managing long-term public health emergencies such as pandemics: (1) centralised pooling and management of resources; (2) engagement of local communities in response efforts; (3) the need to continuously recruit and train staff; (4) the establishment of adjusted working patterns to prevent staff exhaustion; (5) cooperation of involved agencies with security for enforcing measures; (6) the revision of funding frameworks; and (7) the use of global positioning system (GPS) data to identify population movement patterns.

CONCLUSION: Although still speculative at this stage, we apply these lessons to the current SARS-CoV-2 pandemic. We argue that immediate action in the areas of resource pooling and control over critical resources, in the engagement of trusted and respected individuals in risk communication, in the continuous training and hiring of new staff, and in the appropriation of GPS tracking data is called for in managing SARS-CoV-2 by policy makers, NGOs and other involved agencies.

Keywords: health system, management, organisational effectiveness, behaviour.

26. Willingness to participate in COVID-19 vaccine trials; a survey among a population of healthcare workers in Uganda

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ABSTRACT

BACKGROUND: Healthcare workers (HCWs) are at high risk of acquiring SARS-CoV-2 and COVID-19 and may therefore be a suitable population for COVID-19 vaccine trials. We conducted a survey to evaluate willingness-to-participate in COVID-19 vaccine trials in a population of HCWs at three hospitals in Uganda.

METHODS: The survey was conducted between September and November 2020. Using a standardised questionnaire, data were collected on socio-demographics, previous participation in health research, COVID-19 information sources, underlying health conditions, and willingness-to-participate in COVID-19 vaccine trials. Data were analysed descriptively and a binomial generalised linear model with a log link function used to investigate factors associated with unwillingness to participate.

RESULTS: 657 HCWs (female, 63%) were enrolled with a mean age of 33 years (Standard Deviation, 10). Overall willingness-to-participate was 70.2%. Key motivating factors for participation were: hope of being protected against COVID-19 (81.1%), altruism (73.3%), and the opportunity to get health care (26.0%). Selected hypothetical trial attributes reduced willingness-to-participate as follows: weekly-quarterly study visits over a 12-month period (70.2%-63.2%, $P = 0.026$); provision of approximately 50ml of blood at each study visit (70.2%-63.2%, $P = 0.026$); risk of mild-moderate local adverse reactions (70.2%-60.3%, $P < 0.001$); chance of receiving candidate vaccine or placebo (70.2%-56.9%, $P < 0.001$); and delay of pregnancy [Overall, 70.2%-57.1% ($P < 0.001$); Female, 62.8%-48.4% ($P = 0.002$); Male, 82.5%-71.5% ($P = 0.003$)]. Collectively, these attributes reduced willingness-to-participate from [70.2%-42.2% ($P < 0.001$) overall; 82.5%-58.1% ($P < 0.001$) in men; 62.8%-32.6% ($P < 0.001$) in women]. Among individuals that were unwilling to participate, the commonest barriers were concerns over vaccine safety (54.6%) and fear of catching SARS-CoV-2 (31.6%). Unwillingness to participate was associated with being female (aRR 1.97, CI 1.46–2.67, $P < 0.001$) and having university or other higher-level education (aRR 1.52, CI 1.05–2.2, $P = 0.026$).

CONCLUSIONS: Willingness-to-participate in COVID-19 vaccine trials among HCWs in Uganda is high but may be affected by vaccine trial requirements and concerns about the safety of candidate vaccines.

27. COVID-19 and Its Related Stigma: A Qualitative Study Among Survivors in Kampala, Uganda

Kabunga Amir

ABSTRACT

COVID-19-related stigma is gradually becoming a global problem among COVID-19 survivors with deleterious effects on quality of life. However, this social problem has received little attention in research and policy. This study aimed at exploring the COVID-19-related stigma among survivors in Kampala, Uganda. A cross-sectional exploratory research design was used among COVID-19 survivors in Kampala district. Thirty COVID-19 survivors were examined using in-depth interviews. Data obtained were analyzed using thematic approach. The findings of study indicated that COVID-19-related stigma is prevalent. The common form of stigma was social rejection and labeling. Results showed that the survivors of COVID-19 pandemic faced social rejection and community ostracism. Based on the results, reducing stigmatization of the COVID-19 survivors is vital to control the spread of the pandemic. Thus, an all-inclusive effort is needed to address COVID-19-related stigma and its debilitating consequences by health workers and policymakers.

Keywords: corona, discrimination, COVID-19, survivors, stigma.

28. Conducting an ongoing HIV clinical trial during the COVID-19 pandemic in Uganda: a qualitative study of research team and participants' experiences and lessons learnt

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ABSTRACT

OBJECTIVE: To explore the experiences and lessons learnt by the study team and participants of the Workplace-based HIV self-testing among Men trial during the COVID-19 pandemic in Uganda.

DESIGN: An explorative qualitative study comprising two virtual focus group discussions (FGDs) with 12 trial team members and 32 in-depth participant interviews (N=44). Data were collected

via telephone calls for in-depth interviews or Zoom for FGDs and manually analysed by inductive content analysis.

SETTING: Fourteen private security companies in two Uganda districts. Participants Members of the clinical trial study team, and men working in private security companies who undertook workplace-based HIV testing.

RESULTS: The key themes for participant's experiences were: 'challenges in accessing HIV treatment and care, and prevention services', 'misinformation' and 'difficulty participating in research activities. The effects on HIV treatment and prevention resulted from; repercussions of the COVID-19 restrictions, participants fear of coinfection and negative experiences at health facilities. The difficulty in participating in research activities arose from: fear of infection with COVID-19 for the participants who tested HIV negative, transport difficulties, limited post-test psychosocial support and lack of support to initiate pre-exposure prophylaxis. The key study team reflections focused on the management of the clinical trial, effects of the local regulations and government policies and the need to adhere to ethical principles of research. **Conclusions** Findings highlight the need to organise different forms of HIV support for persons living with HIV during a pandemic. Additionally, the national research regulators and ethics committees or review boards are strongly urged to develop policies and guidelines for the continuity of research and clinical trials in the event of future shocks. Furthermore, this study calls on the appropriate government agencies to ensure public and researchers' preparedness through continuing education and support.

29. Knowledge and compliance with Covid-19 infection prevention and control measures among health workers in regional referral hospitals in northern Uganda: a cross-sectional online survey

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ABSTRACT

BACKGROUND: Infection prevention and control (IPC) has increasingly been underscored as a key tool for limiting the transmission of coronavirus disease 2019 (Covid-19) and safeguarding health workers from infections during their work. Knowledge and compliance with IPC measures

is therefore essential in protecting health workers. However, this has not been established among health workers in northern Uganda in light of the Covid-19 pandemic. The objective of this study was to determine the knowledge and compliance with Covid-19 infection prevention and control measures among health workers in regional referral hospitals in northern Uganda.

METHODS: An online cross-sectional descriptive study was conducted among health workers in regional referral hospitals within northern Uganda. A structured questionnaire was distributed to health workers via WhatsApp messenger. Sufficient knowledge was considered at a correct response score of $\geq 80\%$, while adequate compliance was rated $\geq 75\%$ of the maximum score. Data were analyzed using SPSS v21.

RESULTS: Of the 213 health workers approached, 75 (35%) participated in the study. The majority were males, 39(52%) and the mean age was 36.92 years. Of the 75 participants, 52(69%) had sufficient knowledge of Covid-19 IPC while 51(68%) had adequate compliance with Covid-19 IPC. Adequate compliance was significantly associated with training in Covid-19 IPC (OR, 2.86; 95% CI, (1.04-7.88); $p=0.039$), access to Covid-19 IPC materials at workstations (OR, 2.90; 95% CI, (1.06 - 8.09); $p=0.036$), and having strong institutional support (OR, 3.08; 95% CI, (1.08 – 8.74); $p=0.031$). However, there was no significant relationship between knowledge and compliance with IPC ($p=0.07$). The socio-demographic characteristics of health workers had no statistically significant relationship with Covid-19 IPC knowledge or compliance.

CONCLUSION: Our results show fairly good knowledge and compliance with Covid-19 IPC among health workers in northern Uganda. There is need for more training and provision of guidelines to promote compliance with Covid-19 IPC.

Keywords: Infection prevention and control, knowledge, training, compliance.

30. Coronavirus Disease 2019 (COVID-19) Mitigation Efforts and Testing During an In-Person Training Event—Uganda, 12–29 October 2020

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Christina Mwangi, Peter Nkurunziza, David Okimait, Dustin Currie, Aderonke Ajiboye, Carole S Moore, Hetal Patel, Sam Sendagala, Mary Naluguza, Veronicah Mugisha, Andrea Low, Stephen Delgado, David Hoos, Kristin Brown, Jennifer S Galbraith, Wolfgang Hladik, Lisa Nelson, Wafaa El-Sadr, Joshua Musinguzi, Andrew C Voetsch

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ABSTRACT

Large public-health training events may result in severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) transmission. Universal SARS-CoV-2 testing during trainings for the Uganda Population-based HIV Impact Assessment identified 28 of 475 (5.9%) individuals with coronavirus disease 2019 (COVID-19) among attendees; most (89.3%) were asymptomatic. Until COVID-19 vaccine is readily available for staff and participants, effective COVID-19 mitigation measures, along with SARS-CoV-2 testing, are recommended for in-person trainings, particularly when trainees will have subsequent contact with survey participants.

Keywords: SARS-CoV-2, COVID-19, mitigation, testing, trainings

13. Socioeconomic impacts of COVID-19 in low-income countries

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ABSTRACT

The emergence of SARS-CoV-2 and attempts to limit its spread have resulted in a contraction of the global economy. Here we document the socioeconomic impacts of the pandemic among households, adults and children in low-income countries. To do so, we rely on longitudinal household survey data from Ethiopia, Malawi, Nigeria and Uganda, originating from pre-COVID-19 face-to-face household surveys plus phone surveys implemented during the pandemic. We estimate that 256 million individuals—77% of the population—live in households that have lost income during the pandemic. Attempts to cope with this loss are exacerbated by food insecurity and an inability to access medicine and staple foods. Finally, we find that student–teacher contact has dropped from a pre-COVID-19 rate of 96% to just 17% among households with school-aged children. These findings can inform decisions by governments and international organizations on measures to mitigate the effects of the COVID-19 pandemic

14. Use of face masks to limit the spread of the COVID-19 among western Ugandans: Knowledge, attitude and practices

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ABSTRACT

BACKGROUND: The world is grappling with an ever-changing COVID-19 pandemic using preventive measures such as personal hygiene, facemasks, restrictions on travel and gatherings in communities, in addition to a race to find a vaccine. The purpose of this study was to evaluate the knowledge, attitudes and practices of the western Uganda community on the proper use of facemasks to mitigate the spread of COVID-19.

METHODS: A cross-sectional study using a structured questionnaire was carried out from 1st July to 10th July 2020 among western Ugandans of consent age of 18 years and above. Data was analysed using Stata version 14.2.

RESULTS: Among the respondents (n = 1114), the mean age was 30.7 (SD 11.1), 51% were males, 53.9% married and 43% had attained secondary education. Most participants (60.1%, n = 670) had satisfactory knowledge on the use of facemasks and participants at a tertiary education level [AOR 2.6 (95% CI: 1.42–4.67; p = 0.002)] were likely to have satisfactory knowledge than participants who had not education. On attitude, most respondents (69.4%) were confident enough to correctly put on a facemask; 83.4% believed that a facemask can protect against COVID-19 and 75.9% of respondents had never shared their facemask. The majority of respondents (95.2%) agreed wearing facemasks in public places was important to protect themselves against COVID-19; 60.3% reported washing their hands before wearing and after removing the facemask. Unfortunately, 51.5% reported removing the facemask if they needed to talk to someone.

CONCLUSION: Despite the satisfactory knowledge, good attitude and practices, there is still much more to be done in terms of knowledge, attitude and practices among participants. Government, non-governmental organizations and civil society should improve sensitization of populations on how to behave with facemasks while talking to avoid the spread of the COVID-19 among western Ugandans.

15. COVID-19 and the HIV care continuum in Uganda: minimising collateral damage

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ABSTRACT

The novel coronavirus, SARS-CoV-2, has spread across the world within months of its first description in Wuhan, China in December 2019, resulting in an unprecedented global health emergency. Whilst Europe and North America are the current epicentres of infection, the global health community are preparing for the potential effects of this new disease on the African continent. Modelling studies predict that factors such as youthful and rural population may be protective in mitigating the spread of COVID-19 in the World Health Organisation (WHO) African Region, however, with 220 million infections and 4.6 million hospitalisations predicted in the first year of the pandemic alone, fragile health systems could still be placed under significant strain. Furthermore, subsequent disruptions to the provision of services for people living with HIV, or at risk of acquiring HIV, are predicted to lead to an extra 500,000 adult HIV deaths and a 2-fold increase in mother to child transmission of HIV in sub-Saharan Africa in 2020-2021. Ignoring these predictions may have severe consequences and we risk “stepping back in time” in AIDS-related deaths to numbers seen over a decade ago. Reflecting on our current experience of the COVID-19 pandemic in Uganda, we explore the potential impact of public health measures implemented to mitigate spread of COVID-19 on the HIV care continuum, and suggest areas of focus for HIV services, policy makers and governments to urgently address in order to minimise the collateral damage.

Keywords: COVID-19, HIV care, PLWHIV, Opportunistic infections, sub-Saharan Africa.

16. Efficacy of Face Masks Used in Uganda: A Laboratory-Based Inquiry during the COVID-19 Pandemic

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ABSTRACT

With shortages of facemasks being reported worldwide, it is critical to consider alternatives to commercially manufactured facemasks. This study aimed to test and compare the efficacy of various makes of locally made or homemade cloth facemasks obtained from facemask vendors in Kampala, Uganda, during the COVID-19 pandemic. The testing was performed to assess the bacterial filtration efficiency (BFE), breathability, distance-dependent fitness, and reusability of the locally made or homemade cloth facemasks, while considering the most commonly used non-published facemask decontamination approaches in Uganda. During laboratory experimentation, modified protocols from various facemask testing organizations were adopted. Ten different facemask types were experimented upon; each face-mask type was tested four times for every single test, except for the decontamination protocols involving washing where KN95 and surgical face masks were not included. Among the locally made or homemade cloth facemasks, the double-layered cloth facemasks (described as F) had better BFE and distance-dependent fitness characteristics, they could be reused, and had good breathability, than the other locally made or homemade cloth face masks. Despite these good qualities, the certainty of these face masks protecting wearers against COVID-19 remains subject to viral filtration efficiency testing.

17. A Descriptive-Multivariate Analysis of Community Knowledge, Confidence, and Trust in COVID-19 Clinical Trials among Healthcare Workers in Uganda

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ABSTRACT

BACKGROUND: misinformation and mistrust often undermines community vaccine uptake, yet information in rural communities, especially of developing countries, is scarce. This study aimed to identify major challenges associated with coronavirus disease 2019 (COVID-19) vaccine clinical trials among healthcare workers and staff in Uganda.

METHODS: a rapid exploratory survey was conducted over 5 weeks among 260 respondents (66% male) from healthcare centers across the country using an online questionnaire. Twenty-seven questions assessed knowledge, confidence, and trust scores on COVID-19 vaccine clinical trials from participants in 46 districts in Uganda.

RESULTS: we found low levels of knowledge (i.e., confusing COVID-19 with Ebola) with males being more informed than females (OR = 1.5, 95% CI: 0.7–3.0), and mistrust associated with policy decisions to promote herbal treatments in Uganda and the rushed international clinical trials, highlighting challenges for the upcoming Oxford–AstraZeneca vaccinations. Knowledge, confidence and trust scores were higher among the least educated (certificate vs. bachelor degree holders). We also found a high level of skepticism and possible community resistance to DNA recombinant vaccines, such as the Oxford–AstraZeneca vaccine. Preference for herbal

treatments (38/260; 14.6%, 95% CI: 10.7–19.3) currently being promoted by the Ugandan government raises major policy concerns. High fear and mistrust for COVID-19 vaccine clinical trials was more common among wealthier participants and more affluent regions of the country.

CONCLUSION: our study found that knowledge, confidence, and trust in COVID-19 vaccines was low among healthcare workers in Uganda, especially those with higher wealth and educational status. There is a need to increase transparency and inclusive participation to address these issues before new trials of COVID-19 vaccines are initiated.

Keywords: COVID-19 clinical trials in resource poor countries; COVID-19; clinical trials in Africa; COVID-19 and medical workers; vaccines; COVAX

18. Experiences of persons in COVID-19 institutional quarantine in Uganda: a qualitative study

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ABSTRACT

BACKGROUND: Quarantine has been adopted as a key public health measure to support the control of the Coronavirus disease (COVID-19) pandemic in many countries Uganda adopted institutional quarantine for individuals suspected of exposure to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) to be placed in institutions like hotels and/or hostels of institutions for at least 14 days. This study explored experiences of individuals who underwent institutional quarantine in Uganda to inform measures to increase its effectiveness and reduce its associated negative impact.

METHODS: We conducted a qualitative description study using in-depth interviews with 20 purposively selected individuals who had spent time in institutional quarantine facilities. These were mainly phone-based interviews that were audio recorded and transcribed verbatim. Electronic data coding was conducted using Atlas.ti 7 software. Thematic content analysis was used to synthesize the findings with similar codes grouped to form sub-themes and ultimately study themes. The findings are presented thematically with typical participant quotes.

RESULTS: Study participants spent between 14 to 25 days in institutional quarantine. Four themes emerged describing the experiences of study participants during institutional quarantine, which determined whether participants' experiences were positive or negative. These themes were: quarantine environment including facility related factors and compliance with COVID-19 measures; quarantine management factors of entity paying the costs, communication and days spent in quarantine; individual factors comprising attitude towards quarantine, fears during and post-quarantine and coping mechanisms; and linkage to other services such as health care and post quarantine follow-up.

CONCLUSION: The planning, management and implementation of the quarantine process is a key determinant of the experiences of individuals who undergo the measure. To improve the experience of quarantined individuals and reduce its associated negative impact, the pre-quarantine process should be managed to comply with standards, quarantined persons should be provided as much information as possible, their quarantine duration should kept short and costs of the process ought to be minimised. Furthermore, quarantine facilities should be assessed for suitability and monitored to comply with guidelines while avenues for access to healthcare for the quarantined need to be arranged and any potential stigma associated with quarantine thoroughly addressed.

Keywords: Challenges, Coping, COVID-19, SARS-CoV-2, Experiences, Institutional, Quarantine

19. With the radio blaring, can information from community health-worker home talks be heard? Evaluation of a COVID-19 home-talk programme in Kisoro, Uganda

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ABSTRACT

BACKGROUND: As the rate of COVID-19 infections grew in Kisoro, Uganda, fear and misinformation about the virus were rife. Accurate, trustworthy community education seemed essential to support prevention efforts in the villages, allay widespread fear of death, and avoid the overwhelming of Kisoro District Hospital (KDH). Since 2005, KDH has collaborated with an NGO, Doctors for Global Health (DGH) and the Albert Einstein College of Medicine, NY, USA, to sponsor a robust Village Health Worker (VHW) programme in 52 villages in the Kisoro district.

Community health education has been a cornerstone of the programme since its inception, and VHW-delivered home talks with portable, pictorial flip charts have shown success as a model for health education. Here, we describe a COVID-19 home-talk programme developed in a short time in response to the COVID-19 pandemic and evaluate learning from this programme compared with learning from local radio (the main channel of information) and other regional information sources. In a COVID-19 lockdown, would the home-visit model be applicable? Would a health-worker delivered home-talk programme add to learning otherwise garnered from radio, television or neighbours?

METHODS: We developed a 30 min COVID-19 home talk in 10 days; we trained 48 VHWs in an intense 2-day training, then monitored and certified VHW's skills over three sessions of field observation. Home talks were then fully implemented with a maximum of four adults per talk and social distancing was observed. To measure the retained learning from home talks, one adult per talk answered a six-item pre-test, and 3–5 weeks later, we randomly selected 20% of these participants and invited them to complete an identical post-test. To control for media exposure and assess contamination of the talk messages over time in study villages, residents of non-participating villages also completed tests at the same time that study participants completed post-tests in participating villages.

FINDINGS: In the 3 months between April 20, 2020, and June 16, 2020, 48 VHWs gave 4308 COVID-19 home talks to more than 14000 adults who have minimal education. Participants' post-test scores were 20% higher than pre-test scores and 30% higher than controls' test scores ($p < 0.0001$) and were independent of the VHW's presentation skills. Significant learning was seen surrounding COVID-19 symptoms, mechanisms of spread, disease prevention, and risks of mortality, but not about when to go to the hospital with symptoms. Most participants (82%) reported understanding and valuing information from the COVID-19 home talks more than they did information heard via the radio.

INTERPRETATION: Despite ubiquitous coverage of COVID-19 issues in the popular media, small group home talks by VHWs were preferred by rural villagers in Uganda and resulted in new, retained learning. We believe that this preference was probably the result of trust in the VHW and the opportunity to focus and ask questions. Corollary learning by word of mouth also occurred in home talk villages.

20. Violence and discrimination among Ugandan residents during the COVID-19 lockdown

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ABSTRACT

BACKGROUND: In March 2020, the World Health Organization (WHO) declared COVID-19 a pandemic. Many countries in Sub-Saharan Africa, Uganda inclusive, implemented lockdowns, curfew, banning of both private and public transport systems, and mass gatherings to minimize spread. Social control measures for COVID-19 are reported to increase violence and discrimination globally, including in Uganda as some may be difficult to implement resulting in the heavy deployment of law enforcement. Media reports indicated that cases of violence and discrimination had increased in Uganda's communities following the lockdown. We estimated the incidence and factors associated with experiencing violence and discrimination among Ugandans during the COVID-19 lockdown to inform control and prevention measures.

METHODS: In April 2020, we conducted a secondary analysis of cross-sectional data under the International Citizen Project (ICP) to assess adherence to public health measures and their impact on the COVID-19 outbreak in Uganda. We analyzed data on violence and discrimination from the ICP study. We performed descriptive statistics for all the participants' characteristics and created a binary outcome variable called experiencing violence and/or discrimination. We performed logistic regression analysis to identify the factors associated with experiencing violence and discrimination.

RESULTS: Of the 1726 ICP study participants, 1051 (58.8%) were males, 841 (48.7%) were currently living with a spouse or partner, and 376 (21.8%) had physically attended work for more than 3 days in the past week. Overall, 145 (8.4%) experienced any form of violence and/or discrimination by any perpetrator, and 46 (31.7%) of the 145 reported that it was perpetrated by a law enforcement officer. Factors associated with experiencing violence or discrimination were: being male (AOR = 1.60 CI:1.10–2.33), having attended work physically for more than 3 days in the past week (AOR = 1.52 CI:1.03–2.23), and inability to access social or essential health services since the epidemic started (AOR = 3.10 CI:2.14–4.50).

CONCLUSION: A substantial proportion of Ugandan residents experienced violence and/or discrimination during the COVID-19 lockdown, mostly perpetrated by law enforcement officers. We recommend mitigation of the collateral impact of lockdowns with interventions that focus on improving policing quality, ensuring continuity of essential services, and strengthening support systems for vulnerable groups including males.

Keywords: COVID-19, Lockdown, Violence, Discrimination, Epidemic, Uganda, Law enforcement, Police violence, Sub-Saharan Africa.

21. Effects of the COVID-19 Pandemic on Health Services and Mitigation Measures in Uganda

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CGD Working Paper 571. Washington, DC: Center for Global Development.
<https://www.cgdev.org/publication/effects-covid-19-pandemic-health-services-and-mitigation-measures-Uganda-descriptive>.

ABSTRACT

On 21st March 2020, Uganda reported its first COVID-19 case. The government responded by instituting a lockdown and other measures. We assess the effects of the COVID-19 containment measures on health services to better inform the next preventive measures. We use a case study approach that involved document reviews and secondary analysis of data on attendance of key health services and mortality for the years 2019 and 2020. The services included outpatient department (OPD), antenatal care (ANC), malaria, immunization, TB, and hypertension. Interrupted time series analysis was applied to test the significance of difference between pre- and post-intervention. We find that from March to April 2020, attendance to health services reduced and then rose in June or July. Notable reduction was in general OPD (17%), malaria-OPD (7%), ANC (8%), immunization (10%), hypertension (17%), and diabetes (10%). Institutional mortality reduced in same period. The intervention significantly affected the level and trends of malaria-OPD and immunization. We conclude that the lockdown reduced access to health services while institutional mortality fell due to reduced number of patients. There is need to emphasize other mitigation measures rather than lockdowns.

22. Mathematical modelling of COVID-19 transmission dynamics in Uganda: Implications of complacency and early easing of lockdown

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PLOS ONE | <https://doi.org/10.1371/journal.pone.0247456> February 22, 2021

ABSTRACT

BACKGROUND: Uganda has a unique set up comprised of resource-constrained economy, social-economic challenges, politically diverse regional neighborhood and home to long-standing refugee crisis that comes from long and protracted conflicts of the great lakes. The devastation of the on-going global pandemic outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is likely to be escalated by these circumstances with expectations of the impact of the disease being severe.

MATERIALS AND METHODS: In this study, we formulate a mathematical model that incorporates the currently known disease characteristics and tracks various intervention measures that the government of Uganda has implemented since the reporting of the first case in March 2020. We then evaluate these measures to understand levels of responsiveness and adherence to standard operating procedures and quantify their impact on the disease burden. Novel in this model was the unique aspect of modeling the trace-and-isolate protocol in which some of the latently infected individuals tested positive while in strict isolation centers thereby reducing their infectious period.

RESULTS: The study findings show that even with elimination of all imported cases at any given time it would take up to nine months to rid Uganda of the disease. The findings also show that the optimal timing of easing of lockdowns while mitigating the possibility of re-emergence of a second epidemic wave requires avoiding the scenario of releasing too-many-too-soon. It is even more worrying that enhancing contact tracing would only affect the magnitude and timing of the second wave but cannot prevent it altogether.

CONCLUSION: We conclude that, given the prevailing circumstances, a phased-out lifting of lockdown measures, minimization of COVID-19 transmissibility within hospital settings, elimination of recruitment of infected individuals as well as enhanced contact tracing would be key to preventing overwhelming of the healthcare system that would come with dire consequences.

23. The Impact of COVID-19 on Persons with Disabilities in Uganda

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Available at SSRN: <https://ssrn.com/abstract=3773996>: Date Written: November 11, 2020;
Posted: 1 Feb 2021

ABSTRACT

The age of the pandemic has seen a global imposition of lockdowns and obligatory social distancing rules by many of African countries. The paper shall draw upon Ugandan circumstances as a case study. The case study shall be used in advancing an explanatory account of how and why total lockdowns and social distancing rules are disproportionately affecting persons with disabilities (PWDs) in as far as their realisation of the right to health is concerned. This paper shall be underpinned by theories which are founded upon the implicit interactions that the pandemic has with broader themes of increasing health inequalities *visa vie* the right based idea of equal access to social justice and distributive equity. The research shall expound on interactions which are manifestly underlying exceptions of the above lockdown polices that are conceptualising and applying the vulnerability theory upon paradigms which are largely inclusionary of gender related health related issues while exclusionary to disability related issues. The research shall also assert that in the course of discussing and applying social distancing rules, special consideration should be made to the closely detachable state of relation between persons with disabilities and their supportive personnel or carers.

Keywords: COVID-19, Disabilities, Uganda

24. COVID-19 PANDEMIC AND BEHAVIOURAL RESPONSE TO SELF-MEDICATION PRACTICE IN WESTERN UGANDA

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ABSTRACT

BACKGROUND: Self-medication has become is a serious public health problem globally posing great risks, especially with the increasing number of cases of COVID-19 disease in Uganda. This is may be partly because of the absence of a recognized treatment for the disease, however, the prevalence and nature differ from country to country, which may influence human behavioural responses.

AIM: This study aimed to investigated the behavioural response of the community towards self-medication practices during this COVID-19 pandemic and lockdown.

METHODS: A cross sectional household and online survey was conducted during the months of June-to August. The study was conducted among adult between age 18 above in communities of western Uganda who consented to participate in the study. Study participants were selected using a convenience sampling technique and sampling was done by sending a structured online questionnaire via Google forms and a printed copies questionnaire made available to other participants that did not use the online questionnaire

RESULTS: The percentage of respondents that know about self-medication is (97%) and those that practice self-medication are approximately (88%). 97% of respondents have heard about self-medication either through health workers, media, family members, friends and/or school while 3% said they have not heard about self-medication. The percentage of respondents who practiced self-medication during COVID-19 pandemic is 57% while those that did not is 43%. There is statistically difference in the number of those that practice self-medication and those that do not $p < 0.005$ at 95% confidence interval. Also there was a statistically significant decrease in the number of respondents that practice self-medication during COVID-19 pandemic lockdown compare to the practice before the pandemic lockdown $p < 0.05$ at 95% confidence interval.

CONCLUSION: Our investigation showed adequate knowledge of self-medication and high level of self-medication practice with a decrease in self-medication practices during the COVID-19 pandemic lockdown compared to the practice before the lockdown.

Keywords: Covid-19, self-medication, pandemic, behavioural response, lockdown, drugs

25. The impact of COVID-19 measures on children with disabilities and their families in Uganda

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ABSTRACT

To understand the impact of the COVID-19 public health response on families of children with disabilities in Central Uganda we conducted phone interviews with parents and children during the first 5 months of the outbreak (March - July 2020). Most parents and children were well informed about COVID-19 and were keen to adhere to government prevention measures. The majority said lock-down measures had a negative effect on their mental and physical health, social life, finances, education and food security. Access to medical services and medication for chronic illness had been limited or absent due to restrictions in travel, some facilities restricting access, and limited financial resources. The majority of parents reported loss of work which resulted in difficulties in finding enough food and paying rent. Parents worried about children missing education and friends. We suggest greater attention to children with disabilities and their families when implementing mitigating and long-term responses.

Points of interest

- This paper reports a study with families of children with disabilities in Uganda during the Coronavirus pandemic in 2020, known as COVID-19.
- Families of children with disabilities in Uganda are well informed about COVID-19 and try to follow prevention measures.
- Families of children with disabilities have difficulties meeting daily basic needs as they were unable to work and had no income during the COVID-19 related lock down.
- The COVID-19 response affects access to health and rehabilitation services for children with disabilities in Uganda.
- Parents of children with disabilities struggle with home education and learning due to lack of access to accessible learning materials and learning support in Uganda.

- The COVID-19 response affects the peer support networks and social support for parents of children with disabilities in Uganda.
- Children with disabilities and their families should be involved and considered in the development and implementation of the COVID-19 response.

Keywords: Disability, COVID 19, families, children, Africa, Uganda

26. COVID-19 Awareness, Adoption of COVID-19 Preventive Measures, and Effects of COVID-19 Lockdown Among Adolescent Boys and Young Men in Kampala, Uganda

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ABSTRACT

There is growing evidence of the challenges with adherence to COVID-19 prevention measures and the effect of the prevention measures on the health of populations in various parts of the world but with limited documentation in sub-Saharan Africa. We assessed COVID-19 awareness, adoption of COVID-19 prevention measures, and the effects of COVID-19 lockdown on the mental health status, socio-economic disruptions and engagement in unhealthy behaviours among 2500 in- and out of school adolescent boys and young men (ABYM) aged 10–24 years in Kampala, Uganda. 74.8% (n=1869) were in school; nearly half (47.3%, n=1182) were aged 15–19 years. Although >80% were aware of at least two COVID-19 prevention measures, only 22.2% (n=555) reported that they always wore a facemask while in a public place; 40.9% (n=1023) always washed their hands with soap and running water while 17.6% (n=440) always avoided gatherings of more than five people. COVID-19 lockdown led to: (a) increased mental health challenges (e.g. 1.2% [n=31] contemplated committing suicide); (b) limited ability to meet basic needs (e.g. 62.0% [n=1549] found it difficult to afford a diverse/balanced diet); (c) socio-economic disruptions (e.g. 30.3% [n=756] experienced a reduction in income) and (d) engagement in unhealthy behaviours (e.g. 62% [n=1554] reported a sedentary life style such as excessive watching of TV). These effects were more pronounced among older adolescent boys (15–19 years) and young men (20–24 years) and out-of-school compared to in-school ABYM. Our findings suggest a need for appropriate health promotion, mental health and socio-economic interventions targeting ABYM in Kampala, Uganda.

Keywords: COVID-19 · Lockdown · Adolescent boys and young men · Kampala · Uganda

27. COVID-19 Educational Disruption and Response: Rethinking e-Learning in Uganda

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University of Cambridge, 2020 - researchgate.net

ABSTRACT

COVID-19 Educational Disruption and Response: Rethinking e-Learning in Uganda Public health emergencies affect the education and safety of children in several ways. Due to the Ebola outbreak in West Africa, for instance, the education of 5 million children was interrupted. - School closures across Guinea, Liberia and Sierra Leone between 2014 and 2015 made it difficult for the governments of these countries to find alternative ways to provide continued education, resulting in many children dropping out of school. The current pandemic has forced most governments around the world to temporarily close educational institutions in an attempt to contain the spread of the coronavirus (COVID-19) pandemic, impacting over 91% of the world's student population according to UNESCO. Uganda, amidst its economic challenges, the unforeseen situation of the COVID-19 pandemic is another turn of the screw in the education situation of its school-going age population. This research looks systematically at the opportunities and challenges of diffusing e-learning in the context of Uganda, where the vast majority lack basic needs for livelihood and access to the internet is a problem.

28. COVID-19 and the water–energy–food nexus in Africa: Evidence from Nigeria, Uganda, and Tanzania

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ABSTRACT

Water, energy, and food are necessary resources for well-being and economic development. The physical and economic access to these resources in most Sub-Saharan countries remains very low while the outbreak of COVID-19 is projected to worsen the situation. Therefore, this study aims to assess the impacts of COVID-19 on the access to water, energy, and food as well as to identify innovations in water sanitation and hygiene (WASH) practices and examine the current

policy interventions in Nigeria, Uganda, and Tanzania. An online survey through a Google Forms sampling 842 respondents was adopted and responses were analyzed. Results indicate that there is an insignificant correlation of COVID-19 with water and energy access in all the three countries. However, there is a significant relationship with food access in all the three countries though still minimal in Tanzania. Interestingly, there is an improvement in WASH due to increased local innovations and continued mass sensitization. The study highly recommends policies that could improve affordability and encourage innovations in the factors studied.

Keywords: COVID-19, innovation, policies, water–energy–food access.

29. Knowledge, Attitude, and Self-Reported Practice Toward Measures for Prevention of the Spread of COVID-19 Among Ugandans: A Nationwide Online Cross-Sectional Survey

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Front. Public Health, 15 December 2020 | <https://doi.org/10.3389/fpubh.2020.618731>

ABSTRACT

BACKGROUND: The world is facing the Coronavirus pandemic, which is highly infectious. Several measures have been put in place to prevent its spread among the population. However, for these preventive measures to be effective, the population requires appropriate and sufficient knowledge, attitude, and practices. Thus, a survey to assess knowledge, attitude, and self-reported practice toward measures for prevention of the spread of COVID-19 was conducted among Ugandans.

METHODS: This was a cross-sectional study conducted among during the lockdown in Uganda. An online structured questionnaire was used, applying a snowballing sampling approach for recruitment of participants 18 years and above and residing in Uganda. Data collection was done from 6th to 15th April 2020, during which 1,763 people participated. We analyzed all data using STATA 14.2, applying appropriate statistical tests.

RESULTS: Out of 1,763 participants, 80% were highly knowledgeable. For attitude, 72.4% reported following recommendations given by the Ministry of health to prevent the spread of

COVID-19; 89.0% were worried about contracting COVID-19 and 73.3% agreed that COVID-19 can be cured and 99.3% reported good practice toward measures to prevent the spread of COVID-19. According to ordered logistic regression, health workers were 6 times more knowledgeable [aOR:6 (3.51–10.09), $p < 0.001$] followed by teachers [aOR:5.2 (2.6–10.32), $p < 0.001$]; students [aOR:3.2 (1.96–5.33), $p < 0.001$]. On the contrary, the drivers, business entrepreneurs, and security personnel had less knowledge.

CONCLUSION: The results show that the participating Ugandans were knowledgeable and had a positive attitude and good practices. However, there is still a gap in knowledge among drivers, business entrepreneurs, and security personnel. Therefore, there is a need to mobilize the country's population to have the same degree of knowledge, which will have an impact on the attitude and practices toward prevention of the spread of COVID-19.

Keywords: knowledge, attitude, self-reported practice, COVID-19, Ugandan

30. Findings of a Cross-Sectional Survey on Knowledge, Attitudes, and Practices about COVID-19 in Uganda: Implications for Public Health Prevention and Control Measures

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Hindawi BioMed Research International Volume 2020, Article ID 5917378, 8 pages <https://doi.org/10.1155/2020/5917378>. Published 10 December 2020

ABSTRACT

BACKGROUND: The coronavirus disease (COVID-19) morbidity is rising in Uganda. However, data are limited about people's knowledge, attitudes, and practices. Objective. To determine knowledge about COVID-19, attitudes towards presidential directives and Ministry of Health (MoH) guidelines, and adherence to practicing public health preventive measures (KAP) in Uganda.

METHODS: This cross-sectional survey was conducted between April 28 and May 19, 2020. Data were collected using online social media platforms, websites, and popular media outlets. We descriptively summarized data and categorized KAP scores as knowledgeable about COVID-19, positive attitude towards presidential directives and MoH guidelines, and adherent to public health preventive measures, respectively. We tested sex differences in KAP using tests of significance and established independently associated factors using modified Poisson regression analysis, reported using adjusted prevalence risk ratio (aPR) with 95% confidence interval (CI).

RESULTS: We studied 362 participants with the following sociodemographic characteristics: 86 (23.8%) aged 25-29 years, 212 (58.6%) males, 270 (74.6%) with tertiary or university levels of education, and 268 (74.0%) urban residents. Of the 362 participants, 264 (93.9%) were knowledgeable about COVID-19 (94.1% males and 93.8% females), 51.3% had positive attitudes towards presidential directives and MoH guidelines (51.0% male and 51.8% female), and 175 (48.3%) were adherent to practicing public health preventive measures (42.9% males and 56.0% females). Compared to males, our data shows that females were more adherent to practicing public health preventive measures (aPR, 1.23; 95% CI, 1.01 - 1.53), knowledgeable about COVID-19 (aPR, 1.01; 95% CI, 0.95-1.07), and had positive attitudes towards directives and guidelines (aPR, 1.01; 95% CI, 0.82-1.25). **Conclusions.** This study shows that public health prevention efforts should be directed to closing the identified gaps in KAP among Ugandans in order to halt the spread of COVID-19 in Uganda as well as the East African region.

31. Household response to an extreme shock: Evidence on the immediate impact of the Covid-19 lockdown on economic outcomes and well-being in rural Uganda

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ABSTRACT

We provide evidence on the economic and well-being impact of the Covid-19 lockdown on a sample of households in rural Uganda. Our sample consists of 1,277 households randomly drawn from 114 rural villages in western Uganda and surveyed in-person in early March 2020, just before the lockdown. We followed up with this sample in May 2020, reaching over 85% of them by phone. We find a large decline of 60% in household non-farm income due to household enterprise profits and labour income being almost wiped-out post the lockdown. Households respond to this loss of income in three key ways. One, there is a 40% decrease in food expenditure per adult equivalent. Two, they use up nearly 50% of their savings and borrow more, but have not yet liquidated their fixed assets or sold livestock. Three, they increase total household labour supply to household farm and livestock, more than making up for the decline in supply to enterprises and labour outside the household. We find a decrease in well-being as a result of this: there is an increase in the likelihood of missing a meal, a decline in reported satisfaction with quality of life, a higher likelihood of having a major argument with their spouse and an increase in perceived frequency of intimate partner violence against women in the village. The negative effects of the lockdown are greater for households that were wealthier at baseline, since these households were more reliant on enterprise and salaried income. These results were one of the first to show a large negative impact of the lockdown for a rural population. Our findings are important to policy makers in Uganda and other developing countries as they suggest income and consumption support is needed for rural households.

Keywords: Developing countries, Covid-19, Agricultural households Poverty, Welfare, Well-being.

32. The Effect of Covid19 on the Ugandan Macroeconomy

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ABSTRACT

The purpose of this research study was to analyze the effects of COVID 19 on the Ugandan macro economy. The dependent variable was Uganda's macroeconomy while the independent variable was Covid19 pandemic. Uganda's macroeconomy was measured using macroeconomic indicators and these included; the country's interest rates, exchange rates, business tendency indicator and price levels. The study used secondary data from Uganda Bureau of Statistics and Bank of Uganda from January 2020 to April 2020. A retrospective – prospective research design was used to basically analyze trends of these variables. The results indicated increase in the general price levels. The end period exchange rate of the Uganda shilling against the dollar increased in March 2020, the Central Bank rate reduced in April 2020 while the rediscount rate reduced. For the real sector, the business tendency indicator reduced in April 2020. The study recommended that the government of Uganda considers the health sector priority, embarks on import substitution industrialization since the economy's export base is low at the moment, encourage and support innovations for ideas and machinery that can be manufactured in Uganda rather than importing them, boosts the private sector by contracting when she makes her government procurements, uses Uganda Development Bank to issue low interest loans with a substantial grace period but with collateral security from borrowers.

Key words: Economic effects, COVID 19, Uganda, macro economy

33. Impact of COVID-19 public health restrictions on older people in Uganda: “hunger is really one of those problems brought by this COVID”

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International Psychogeriatrics: page 1 of 8 © International Psychogeriatric Association 2021. (<http://creativecommons.org/licenses/by/4.0/>), doi:10.1017/S1041610220004081. Received 30 Jul 2020; revision requested 23 Oct 2020; revised version received 29 Oct 2020; accepted 09 Dec 2020.

ABSTRACT

OBJECTIVES: To explore the impact of COVID-19 public health restrictions on the lives of older adults living in Uganda.

DESIGN: Qualitative semi-structured interview study.

SETTING: Participants' homes.

PARTICIPANTS: Older adults living in Uganda (aged 60+).

MEASUREMENTS: Older adults in Uganda were interviewed over the phone and asked about their lives before and since COVID-19, and how public health restrictions have affected their lives. Semi-structured interviews were audio-recorded, transcribed and translated into English. Transcripts were thematically analyzed and themes generated in discussion.

RESULTS: In total, 30 older adults participated in the study. Five themes were identified: (1) economic impacts; (2) lack of access to basic necessities; (3) impact on healthcare utilization; (4) social impacts and (5) violent reinforcement of public health restrictions. COVID-19 public health restrictions had severe impacts on their lives, with many people having not enough food to eat due to lack of income, and being unable to pay their grandchildren's school fees. Steep rises in public transport fares and an overall avoidance of transport also resulted in a lack of access to healthcare services and difficulty in getting food. Restrictions were violently reinforced by security guards.

CONCLUSIONS: Public health restrictions have a severe impact not only on older adults but also on the whole family in Uganda. Governmental strategies to contain the virus need to provide more support to enable people to get basic necessities and live as normal a life as possible.

Keywords: Ageing, COVID-19, Developing countries, public health

34. Survey on general awareness, mental state and academic difficulties among students due to COVID-19 outbreak in the western regions of Uganda

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ABSTRACT

This academic research is carried out to assess the general awareness, mental state and academic difficulties among different age groups of students studying in various schools, colleges, or Universities during this lockdown period due to the COVID-19 crisis in the western regions of Uganda. An aggregate of 405 students participated in this survey. Among them 253 students are from rural regions, 59 students are from semi-urban regions and 93 students are from urban regions. This survey is classified into three sections: the first section spotlights the perceptive level of students about the COVID-19 crisis, the second section emphasizes the mental state of students and the final section highlights the academic difficulties faced by the students during this lockdown period. A statistical run is deliberated with the aid of SPSS version 20 software to evaluate the significance level (P-Value<0.05) of each question among the localities.

Keywords: Psychology, Student, Academic, Mental state, Uganda, Pandemic, COVID-19, Lockdown

35. Reflecting on the First Two COVID-19 Deaths in Uganda: A Public Health Perspective

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ABSTRACT

COVID-19 being a rapidly evolving pandemic, early lessons from the first deaths must be learnt to help feed into the public health guidelines. This article, therefore, aims to present the first two deaths due to COVID-19 in Uganda and their public health relevance. This is a case study of the first two COVID-19 deaths reported in Uganda, and the events were prospectively documented. The first case was a 34-year-old female and support staff at a health center II. She first presented with COVID-19 like symptoms before dying on 21st July 2020. The second case was an 80 years old female, who also presented with COVID-19 like symptoms before dying on 24th July 2020. The post-mortem samples of both cases were confirmed positive for COVID-19. This study identifies a need for timely identification and testing of COVID-19 suspects, strengthening of health center capacity, as well as more awareness for effective prevention and control of COVID-19.

Keywords: COVID-19, first death, case study, Uganda, lessons learnt

36. Level and Determinants of Adherence to COVID-19 Preventive Measures in the First Stage of the Outbreak in Uganda

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ABSTRACT

We conducted an online survey in the first two months of the Coronavirus Disease 2019 (COVID-19) epidemic in Uganda to assess the level and determinants of adherence to and satisfaction with the COVID-19 preventive measures recommended by the government. We generated Likert scales for adherence and satisfaction outcome variables and measured them with four preventive measures, including handwashing, wearing face masks, physical distancing, and coughing/sneezing hygiene. Of 1726 respondents (mean age: 36 years; range: 12–72), 59% were males, 495 (29%) were adherent to, and 545 (32%) were extremely satisfied with all four preventive measures. Adherence to all four measures was associated with living in Kampala City Centre (AOR: 1.7, 95% CI: 1.1–2.6) and receiving COVID-19 information from health workers (AOR: 1.2, 95% CI: 1.01–1.5) or village leaders (AOR: 1.4, 95% CI: 1.02–1.9). Persons who lived with younger siblings had reduced odds of adherence to all four measures (AOR: 0.75, 95% CI: 0.61–0.93). Extreme satisfaction with all four measures was associated with being female (AOR: 1.3, 95% CI: 1.1–1.6) and health worker (AOR: 1.2, 95% CI: 1.0–1.5). Experiencing violence at home (AOR: 0.25, 95% CI: 0.09–0.67) was associated with lower satisfaction. Following reported poor adherence and satisfaction with preventive measures, behavior change programs using health workers should be expanded throughout, with emphasis on men.

Keywords: COVID-19; preventive measures; adherence; satisfaction; Uganda

37. Increased child abuse in Uganda amidst COVID-19 pandemic

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ABSTRACT

Globally, COVID-19 lockdown measures have exposed children to more sexual, physical and emotional abuse and neglect. Although the COVID-19 pandemic is likely to have long-lasting adverse psychological effects on children, there have been comparatively few studies on children's health as compared with adults, particularly in low-income countries. Uganda implemented one of the most stringent lockdowns with bans on transportation and gatherings as well as the closure of schools, stores and places of worship. In order to address the dearth of information in less developed regions, the article aims to provide an insight into the increased cases of child abuse in Uganda during the COVID-19 pandemic. The data and information were primarily compiled from government and child welfare organisation open-source databases. The psychosocial impacts of COVID-19 have greatly disrupted the living conditions of children, limiting their access to basic needs such as food and health care. In addition, there is a lack of social support, thus putting children at an increased risk of different forms of child abuse. Since the implementation of the COVID-19 lockdown in Uganda, there has been a rise in the incidence of child abuse. Increased cases of physical and sexual abuse against children have been reported in different parts of the country as well as increased cases of child labour. To strengthen child protection during the COVID-19 pandemic, this article highlights a need for multi-level stakeholder cooperation to ensure increased funding, increased community awareness and sensitisation, early detection and effective management and referral of child abuse cases.

38. Estimating Income Losses and Consequences of the COVID-19 Crisis in Uganda

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ABSTRACT

The recent COVID-19 pandemic has come at an overwhelming cost to both developed and developing countries; Uganda is no exception. Despite having relatively few cases, the pandemic's indirect effects arising from an economic contraction and global recession, as well as the direct effects through ill health and death, are likely to have a devastating impact on poverty levels and people's livelihoods. This paper aims to forecast the distributional consequences of the crisis in terms of its effects on poverty and inequality, and to understand how certain policy responses to the crisis might help to offset those effects. Our findings indicate that the income losses from the crisis are severe, erasing poverty gains of the past 10 years, and reaching well beyond Kampala. Using household-level information from the 2016/17 Uganda National Household survey, we explore four different transfer schemes that the government might use to offset the poverty consequences of the crisis: (i) a universal transfer to all households based on

their adult equivalence size, but excluding households with income from employment in the public sector or a public sector pension; (ii) a transfer of the same size as in (i), but targeted to only those households that were poor before the crisis began; (iii) an expansion of the SAGE grant to all those 65 years old and older; and (iv) a labor-intensive public works program directed at the hardest hit urban areas.

39. Early cases of SARS-CoV-2 infection in Uganda: epidemiology and lessons learned from risk-based testing approaches – March-April 2020

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ABSTRACT

BACKGROUND: On March 13, 2020, Uganda instituted COVID-19 symptom screening at its international airport, isolation and SARS-CoV-2 testing for symptomatic persons, and mandatory 14-day quarantine and testing of persons traveling through or from high-risk countries. On March 21, 2020, Uganda reported its first SARS-CoV-2 infection in a symptomatic traveler from Dubai. By April 12, 2020, 54 cases and 1257 contacts were identified. We describe the epidemiological, clinical, and transmission characteristics of these cases.

METHODS: A confirmed case was laboratory-confirmed SARS-CoV-2 infection during March 21–April 12, 2020 in a resident of or traveler to Uganda. We reviewed case-person files and interviewed case-persons at isolation centers. We identified infected contacts from contact tracing records.

RESULTS: Mean case-person age was 35 (± 16) years; 34 (63%) were male. Forty-five (83%) had recently travelled internationally ('imported cases'), five (9.3%) were known contacts of travellers, and four (7.4%) were community cases. Of the 45 imported cases, only one (2.2%) was symptomatic at entry. Among all case-persons, 29 (54%) were symptomatic at testing and five (9.3%) were pre-symptomatic. Among the 34 (63%) case-persons who were symptomatic, all had mild disease: 16 (47%) had fever, 13 (38%) reported headache, and 10 (29%) reported cough. Fifteen (28%) case-persons had underlying conditions, including three persons with HIV. An average of 31 contacts (range, 4–130) were identified per case-person. Five (10%) case-persons, all symptomatic, infected one contact each.

CONCLUSION: The first 54 case-persons with SARS-CoV-2 infection in Uganda primarily comprised incoming air travellers with asymptomatic or mild disease. Disease would likely not have been detected in these persons without the targeted testing interventions implemented in Uganda. Transmission was low among symptomatic persons and non-existent from asymptomatic persons. Routine, systematic screening of travellers and at-risk persons, and thorough contact tracing will be needed for Uganda to maintain epidemic control.

Keywords: COVID-19, SARS-Cov-2, Epidemiology, Surveillance, Uganda

40. Field evaluation of the performance of a SARS-CoV-2 antigen rapid diagnostic test in Uganda using nasopharyngeal samples

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ABSTRACT

OBJECTIVES: There is a high demand for SARS-CoV-2 testing to identify COVID-19 cases. Real-time quantitative PCR (qRT-PCR) is the recommended diagnostic test but a number of constraints prevent its widespread implementation, including cost. The aim of this study was to evaluate a low cost and easy to use rapid antigen test for diagnosing COVID-19 at the point of care.

METHODS: Nasopharyngeal swabs from suspected COVID-19 cases and low-risk volunteers were tested with the STANDARD Q COVID-19 Ag Test and the results were compared with the qRT-PCR results.

RESULTS: In total, 262 samples were collected, including 90 qRT-PCR positives. The majority of samples were from males (89%) with a mean age of 34 years and only 13 (14%) of the positives

were mildly symptomatic. The sensitivity and specificity of the antigen test were 70.0% (95% confidence interval (CI): 60–79) and 92% (95% CI: 87–96), respectively, and the diagnostic accuracy was 84% (95% CI: 79–88). The antigen test was more likely to be positive for samples with qRT-PCR Ct values 29, with a sensitivity of 92%.

CONCLUSIONS: The STANDARD Q COVID-19 Ag Test performed less than optimally in this evaluation. However, the test may still have an important role to play early in infection when timely access to molecular testing is not available but the results should be confirmed by qRT-PCR.

Keywords: COVID-19 SARS-CoV-2 qRT-PCR Antigen Rapid diagnostic test Performance

41. Acceptance and risk perception of COVID-19 vaccine in Uganda: A Cross sectional study in Western Uganda

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ABSTRACT

BACKGROUND: Many countries have drawn their attention on developing Corona virus disease 2019 vaccine however there is less emphasis on whether this vaccine could be accepted in most of these countries. This study aimed to investigate acceptance and risk perception of COVID-19 vaccine in Uganda.

METHOD: A simplified snowball sampling technique was used to select 1067 respondents of 18-70 years in western Uganda using an online questionnaire from July to September 2020. Vaccine acceptability and risk perception was assessed using odds ratio at 95% confidence interval using R software version 3.6.3.

RESULTS: The acceptance rate for vaccination against COVID-19 was (53.6%; 572/1067) with participants in the reference age group 18-20 (OR: 1; 95%CI: NA); males (OR: 2.1; 95%CI: 1.56-2.71; P=0.000); tertiary level of education (OR: 2.8; 95%CI: 1.25-6.11; P=0.009); students (OR: 3.19; 95%CI: 1.98-5.15; P=0.000) and non-salary earners (OR: 2.29; 95%CI: 1.53-3.44; P=0.000) significantly more likely to accept the vaccine. Results also showed that (46.4%; 495/1067) of the respondents were un-likely to accept the vaccine. About (44.6%; 476/1067) of the respondents were likely to accept vaccine clinical trials with participants in the reference age group 18-20 (OR: 1; 95%CI: NA), students (OR: 2.37; 95%CI: 1.49-3.77; P=0.000), marrieds (OR: 1.3; 95%CI: 1.03-1.69; P=0.028), and non-salary (OR: 1.56; 95%CI: 1.05-2.30; P=0.029) significantly more likely to accept clinical trials. There were (46.7%; 500/1067) of the respondents who perceived the vaccine as being risky with males (OR: 3.13; 95%CI: 2.33-4.21; P=0.000); students (OR: 2.59; 95%CI: 1.63-4.13; P=0.000); Civil servants (OR: 1.49; 95%CI: 0.98-2.25; P=0.063); and non-

salary earners; (OR: 2.34; 95%CI: 1.57-3.47; P=0.000) who significantly perceived the vaccine as being more risky.

CONCLUSION: The level of vaccine acceptance (53.6%) and risk perception (46.7%) was relatively average in western Uganda. In order to ensure successful vaccination process, the government needs to prioritize vaccine acceptance strategies especially among the risky group in the community.

Keywords: COVID-19, vaccine, acceptance, clinical trial, risk perception, western Uganda

42. Mental health problems related to COVID-19: A call for psychosocial interventions in Uganda.

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ABSTRACT

As different countries grapple with COVID-19, stringent measures aimed at controlling its spread have been put in place. However, these preventive measures coupled with the fear of contracting the disease are likely to have negative effects on the mental health of the general population. We describe the containment measures taken by the government of Uganda and highlight how these measures are likely to impact the mental health of different groups of people. We also propose future directions and interventions on mental health problems resulting from COVID-19 pandemic.

Keywords: COVID-19; Uganda-Africa; mental health; psychosocial intervention

43. Sexual and reproductive health problems among Ugandan youth during the COVID-19 pandemic lockdown: An online cross-sectional study

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ABSTRACT

BACKGROUND: The COVID-19 pandemic threatens access to sexual and reproductive health services. With global health emergencies, there is often a total reversal of priorities and access to sexual and reproductive health services may become challenging. The aim of this study was to establish the problems related to sexual and reproductive health among Ugandan youths during the COVID-19 lockdown.

METHODS: This was an online cross-sectional study carried out from April 2020 to May 2020 in Uganda. An online questionnaire was used and participants aged 18years to 30 years recruited using the snowballing approach. The statistical analysis was done using STATA version 14.2.

RESULTS: Out of 724 participants, 203 (28%) reported not having information and/or education concerning sexual and reproductive health (SRH). About a quarter of the participants (26.9%, n=195) reported not having testing and treatment services of sexually transmitted infections available during the lockdown. Lack of transport means was the commonest (68.7%) limiting factor to access to SRH services during the lockdown followed by the long distance from home to SRH facility (55.2%), high cost of services (42.2%) and curfew (39.1%). Sexually transmitted infections were the commonest (40.4%) problem related to SRH during the lockdown followed by unwanted pregnancy (32.4%) and sexual abuse (32.4%). The multivariate regression analysis shows that problems were more prevalent among the co-habiting youth [APR: 2.3 (1.6 - 3.29), p<0.001] followed by unemployed (volunteer or unpaid) [APR: 1.6 (1.03 - 2.64), p: 0.037] than in other participants.

CONCLUSION: The findings of this study show that Ugandan youths have accessing SRH information and services during the COVID-19 lockdown. Cohabiting and unemployed participants were the most affected. Lack of transport means and high cost of services were the major limiting factors to access SRH services among the youths. The findings call for concerted efforts from the Uganda government and international non-governmental organisations to ensure access and availability of SRH services for Ugandan youths during the COVID-19 lockdown.

Keywords: sexual reproductive and rights, COVID 19, lockdown, Uganda, youth, services.

44. Medical Education and E-Learning During COVID-19 Pandemic: Awareness, Attitudes, Preferences, and Barriers Among Undergraduate Medicine and Nursing Students at Makerere University, Uganda

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ABSTRACT

Given the dearth need for healthcare workers in the control of the ongoing COVID-19 pandemic, e-learning has been adopted in many settings to hasten the continuation of medical training. However, there is a paucity of data in low resource settings on the plausibility of online learning platforms to support medical education. We aimed to assess the awareness, attitudes, preferences, and challenges to e-learning among Bachelor of Medicine and Bachelor of Surgery (MBChB) and Bachelor of Nursing (B.NUR) students at Makerere University, Uganda. An online cross-sectional study was conducted between July and August 2020. Current MBChB and B.NUR students aged 18 years or older constituted the study population. Using Google forms, a web-based questionnaire was administered through the Makerere University mailing list and WhatsApp messenger. The questionnaire was developed using validated questions from previously published studies. Overall, 221 participants responded (response rate = 61%). Of the 214 valid responses, 195 (92.1%) were Ugandans, 123 (57.5%) were male, and 165 (77.1%) were pursuing the MB ChB program. The median age was 23 (18 to 40) years. Ownership of computers, smartphones, and email addresses were at 131 (61.2%), 203 (94.9%), and 208 (97.2%), respectively. However, only 57 (26.6%) respondents had access to high or very high-quality internet access. Awareness and self-reported usage of e-learning (MUELE) platforms were high among 206 (96.3%) and 177 (82.7%) respondents, respectively. However, over 50% lacked skills in using the Makerere University e-learning (MUELE) platform. About half (n = 104, 49%) of the students believed that e-learning reduces the quality of knowledge attained and is not an efficient method of teaching. Monthly income (P = .006), internet connectivity quality (P < .001), computer ownership (P = .015) and frequency of usage of academic websites or applications (P = .006) significantly affected attitudes towards e-learning. Moreover, internet costs and poor internet connectivity were the most important barriers to e learning reported by 199 (93%) and 179 (84%) students, respectively. Sensitization and training of students and faculty on e-learning and use of existing learning platforms are important to improve the attitude and use of e-learning. Blended online and use of offline downloadable learning materials would overcome the challenges related to the variable quality of internet access in the country.

Keywords: Medical education, e-learning, challenges, attitudes, COVID-19, medicine and nursing students, Uganda.

45. Gender, Economic Precarity and Uganda Government's COVID-19 Response

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ABSTRACT

Understanding the gender implications of government policy is important for effective implementation. This article examines the gender implications of the COVID-19 government response in a liberalised economy. It sought to examine the gendered effects of the Uganda government's COVID-19 response. Specifically, it interrogated the gendered experiences of males of females of the COVID-19 lockdown, how gender shaped these experiences and how gender can be mainstreamed in the COVID-19 response. Following guidance from the World Health Organisation, Uganda's COVID-19 response included lockdown, massive testing of people in quarantine and at borders, contact tracing, a national community survey and promulgation of laws to penalise non-compliance. The key method of data collection was documents review of both grey and published literature. The key findings showed that the neoliberal economic system in which Uganda's COVID-19 response was implemented cannot effectively serve the interests of all. Rather, gender, compounded with economic, social and regional inequalities converged to produce negative experiences for women and other marginalised groups in relation to health, education, justice and livelihoods. The article concludes by recommending attention to gender and context when designing crisis response strategies. Specifically, to recommends safety nets to enable the vulnerable survive crises like COVID-19.

46. Ethical and human rights considerations in public health in low and middle-income countries: an assessment using the case of Uganda's responses to COVID-19 pandemic

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ABSTRACT

BACKGROUND: In response to COVID-19 pandemic, the Government of Uganda adopted public health measures to contain its spread in the country. Some of the initial measures included refusal to repatriate citizens studying in China, mandatory institutional quarantine, and social distancing. Despite being a public health emergency, the measures adopted deserve critical appraisal using an ethics and human rights approach. The goal of this paper is to formulate an ethics and human rights criteria for evaluating public health measures and use it to reflect on the ethical propriety of those adopted by the government of Uganda to contain the spread of COVID-19.

MAIN BODY: We begin by illustrating the value of ethics and human rights considerations for public health measures including during emergencies. We then summarize Uganda's social and economic circumstances and some of the measures adopted to contain the spread of COVID-19. After reviewing some of the ethics and human rights considerations for public health, we reflect upon the ethical propriety of some of Uganda's responses to COVID-19. We use content analysis to identify the measures adopted by the government of Uganda to contain the spread of COVID-19, the ethics and human rights considerations commonly recommended for public health responses and their importance. Our study found that some of the measures adopted violate ethics and human rights principles. We argue that even though some human rights can sometimes be legitimately derogated and limited to meet public health goals during public health emergencies, measures that infringe on human rights should satisfy certain ethics and human rights criteria. Some of these criteria include being effective, strictly necessary, proportionate to the magnitude of the threat, reasonable in the circumstances, equitable, and least restrictive. We reflect on Uganda's initial measures to combat the spread of COVID-19 and argue that many of them fell short of these criteria, and potentially limit their effectiveness.

CONCLUSION: The ethical legitimacy of public health measures is valuable in itself and for enhancing effectiveness of the measures. Such legitimacy depends on the extent to which they conform to ethics and human rights principles recommended for public health measures.

Keywords: Public health, Human rights, Ethics, COVID-19, Low-income countries, Public health emergencies

47. Characteristics and outcomes of admitted patients infected with SARS-CoV-2 in Uganda

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ABSTRACT

Rationale Detailed data on the characteristics and outcomes of patients with COVID-19 in sub-Saharan Africa are limited.

OBJECTIVE: We determined the clinical characteristics and treatment outcomes of patients diagnosed with COVID-19 in Uganda.

MEASUREMENTS: As of the 16 May 2020, a total of 203 cases had been confirmed. We report on the first 56 patients; 29 received hydroxychloroquine (HCQ) and 27 did not. Endpoints included admission to intensive care, mechanical ventilation or death during hospitalisation.

MAIN RESULTS: The median age was 34.2 years; 67.9% were male; and 14.6% were 130/90mm Hg, and 27.8% had BP of >140/90mm Hg. Laboratory derangements were leucopenia (10.6%), lymphopenia (11.1%) and thrombocytopenia (26.3%). Abnormal chest X-ray was observed in 14.3%. No patients reached the primary endpoint. Time to clinical recovery was shorter among patients who received HCQ, but this difference did not reach statistical significance.

CONCLUSION: Most of the patients with COVID-19 presented with mild disease and exhibited a clinical trajectory not similar to other countries. Outcomes did not differ by HCQ treatment status in line with other concluded studies on the benefit of using HCQ in the treatment of COVID-19.

48. HIV Care Experiences During the COVID-19 Pandemic: Mixed-Methods Telephone Interviews with Clinic-Enrolled HIV-Infected Adults in Uganda

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ABSTRACT

COVID-19 measures that restrict movement may negatively impact access to HIV care and treatment. To contribute to the currently limited evidence, we used telephone interviews with quantitative and qualitative questions to examine how clients perceived COVID-19 and its effect on their HIV care and ART adherence. One hundred (n=100) Ugandan adults on ART from an existing study were randomly selected and enrolled. Interviews were recorded, transcribed, and analyzed using descriptive statistics and rapid content analyses. 76% of clients indicated that COVID-19 negatively impacted travel to HIV clinics; 54% perceived that coming to the clinic increased their risk of acquiring COVID-19; and 14% said that COVID-19 had negatively impacted their ART adherence. Qualitative feedback suggests that fear of COVID-19 infection discouraged clinic attendance while stay-at-home orders helped routinize ART adherence and employ new community-based approaches for HIV care. Addressing negative unintended consequences of COVID-19 lockdowns on HIV care is urgently needed.

Keywords HIV, Adherence, Uganda, Antiretroviral treatment, ART, COVID-19, Pandemic · Mixed methods, Mobile phone, Survey

49. Prevention and response to gender-based violence (GBV) during novel Covid-19 lockdown in Uganda

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ABSTRACT

PURPOSE: The purpose of this paper is to understand the challenges related to fighting gender-based violence (GBV) victims during the lockdown in Uganda and suggest prevention and response to GBV and domestic violence victims and stakeholders amidst the deadly novel coronavirus Covid-19 pandemic.

DESIGN/METHODOLOGY/APPROACH: Content analysis was used to collect data to answer the objective of the study. Relevant documents that related to prevention and response to GBV amidst the deadly novel coronavirus Covid-19 pandemic were reviewed i.e., both print ((inter)-national newspapers i.e., monitor and newspaper), electronic (television and radio) and social media (Facebook and Twitter) and presidential addresses on Covid-19.

FINDINGS: The usual mechanisms that victims go through to report are curtailed and the lockdown and quarantine presented the perpetrators the perfect environment to continue disrespecting victims, as everyone was required to respect the stay at home orders, hence it gave fertile ground for isolation and control of the victims.

ORIGINALITY/VALUE: Proposing prevention and response to GBV during the coronavirus novel Covid-19 pandemic lockdown in Uganda.

Keywords: Challenges, Legal framework, Gender-based violence (GBV), Domestic violence (DV), Violence against women (VAW), Prevention and response

50. COVID-19 relief food distribution: impact and lessons for Uganda

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10. doi: [10.11604/pamj.supp.2020.35.142.24214](https://doi.org/10.11604/pamj.supp.2020.35.142.24214)

ABSTRACT

The COVID-19 pandemic continues to cause uncertainty to Uganda's food security among underprivileged households. The Corona virus Response Team inaugurated a relief food distribution campaign, ensuing from the countrywide COVID-19 lockdown to counter the rising food insecurities in many urban and rural poor households. However, the relief response campaign has received a lot of critics from both rural and urban communities who were planned as the beneficiaries. Three months into the COVID-19 pandemic the population reports; delays in the distribution, poor quality supplies, arrests and continued restrictions, slow paced distribution among household, and a negative impact on the health care system. As a learning from the current experience, we recommend; a multisectoral engagement, better planning, a decentralized food distribution, and formulation of clear food distribution guidelines to guide the future responses. Use of mobile cash transfers to reach out to the food insecure households can support local economies and lower the cost on middlemen and interrelated corruption.

Keywords: COVID-19, impact, lessons

51. COVID-19 pandemic and the widening gap to access cancer services in Uganda

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ABSTRACT

The COVID-19 pandemic and its public health control measures have led to worldwide interruptions in healthcare service delivery, and cancer services are no exception. These interruptions have exacerbated the effects of previously reported barriers to accessing cancer care which was reportedly low even before the pandemic. If these effects are not mitigated, the achievements in cancer control that had already been made could be watered down. Measuring the impact of COVID-19 pandemic control measures on delivery of and access to cancer services in Uganda as well as other countries worldwide can inform the design of current and future responses to epidemics while putting into context other diseases like cancer that have a high burden.

Keywords: Cancer services, COVID-19, cancer control, Uganda

52. COVID-19 Pandemic Deranging Energy Transition in Uganda: Challenges and Prospect

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ABSTRACT

The coronavirus (Covid-19) global pandemic of 2020 is alarming for economic growth and development. Several sectors in the world have experienced shocks, and the energy industry has

intensely suffered as characterised by the massive drop in petroleum prices. Only a pick-up in global oil demand would overcome the oil crisis after the lifting of comprehensive lockdown measures and the economic revamp. During this period, environmental advocates are pressing for the transition from traditional fuel sources like coal and oil to renewable energy sources. Moreover, clean energy projects are more likely to be impacted by the pandemic because of the effect on foreign exchange and the global economy. The energy transition has also faced other major setbacks by the Covid-19 crisis. Globally, many policies related to climate and energy, such as the carbon-trading scheme of the European Union (EU) have been shelved or postponed. This article thus explores the Covid-19 impact on the global economies with a focus on Uganda which is yet to start actual petroleum production and how they face challenges in adapting to the energy transition movement. The governments are encouraged to realign policies and also extend Covid-19 fiscal recovery packages to cover clean energy investments.

Keywords: Covid-19; Global Economy; Oil and Gas Crisis; Clean Energy; Energy Transition.

53. COVID 19: Lets act now: the urgent need for upscaling agroecology in Uganda (2020)

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ABSTRACT

The COVID 19 pandemic has ravaged most parts of the world leading to multiple negative effects as restrictions in movement have ensued. Uganda as a country has not been spared with such pandemics also known to disrupt food systems. The aim of this paper is to critically reflect and argue for alternative food systems in Uganda like agroecology that are deemed more resilient in times of pandemics like COVID 19. We review and critically analyze the elements of agroecology in this respect and make strong recommendations for upscaling agroecology in Uganda.

Keywords: Agroecology, COVID 19, Uganda

54. Community Drivers Affecting Adherence to WHO Guidelines Against COVID-19 Amongst Rural Ugandan Market Vendors

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Frontier Public Health, 03 July 2020 | <https://doi.org/10.3389/fpubh.2020.00340>

ABSTRACT

BACKGROUND: Market vendors occupy a strategic position in the fight against the spread of SARS CoV-2 in rural Uganda. To successfully contain the spread of the virus, special attention needs to be given to this set of people by assessing the type of information, source of information, and practices they inculcate as regards adherence to WHO guidelines in the fight against COVID-19 in Uganda. The study aimed to assess the role of information sources, education level, and phone internet connectivity in influencing COVID-19 knowledge among the rural market vendors; and the relationship existing between knowledge, attitude, and practices among them.

METHODS: The study was a descriptive cross-sectional study among rural market vendors ($n = 248$) in southwestern Uganda. Information was collected using a questionnaire and descriptively presented as frequency and percentages.

RESULTS: The study showed that the majority of the rural market vendors had sufficient information regarding COVID-19 with the majority being female individuals and have attained a secondary level of education, The general percentage score for knowledge, attitude, and practices were (75.57, 82.6, and 76.50% respectively). There was a positive correlation between attitude and practices ($r = 0.17$, $p = 0.007$), as well as their knowledge with practices ($r = 0.29$, $p < 0.001$). The majority of the people in the population did not have their phones connected to the internet (OR = 1.96, 95%CI: 1.16–3.31, $P = 0.01$). The majority of people received their information regarding COVID-19 from one source (radio) (OR = 1.55).

CONCLUSION: Where and how the rural market vendors get their information and education level are vital in breaking COVID 19 infection circle in line with WHO guidelines. Therefore, sources of information and education level played a key role in molding their knowledge and practices. However, the level of knowledge on COVID 19 among our respondents was not linked with phone internet connectivity.

Keywords: COVID-19, SARS CoV-2, market-vendors, information on COVID-19, rural community, Africa response to COVID-19, COVID-19 in Uganda

55. COVID-19 Response in Sub-Saharan Africa: Lessons from Uganda

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ABSTRACT

The prolongation of the Ebola epidemic may have allowed some countries to prepare and respond to the coronavirus disease (COVID-19) outbreak. In Uganda, the surveillance structure built for Ebola virus disease (EVD) has become a pillar in the COVID-19 response. This testing and tracing apparatus has limited disease spread to clusters with zero mortality compared with the neighboring East African countries. As more sub-Saharan countries implement social distancing to contain the outbreak, the interventions should be phased and balanced with health risk and socioeconomic situation. However, having a decision-making matrix would better guide the response team. These initial lessons from EVD-experienced Uganda may be helpful to other countries in the region.

Key Words: COVID-19, Ebola, response, SARS CoV-2

56. The socio-economic and psychosocial impact of Covid-19 pandemic on urban refugees in Uganda

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ABSTRACT

Considering the COVID-19 global public health crisis, this paper examines the socio-cultural, economic and psychosocial impact of the pandemic on urban refugees in Uganda. We analyse the living conditions of urban refugees that make it problematic for them to adhere to public health

measures. Since COVID-19 is perceived as “imported”, refugees are assumed as its potential transmitters, consequently experiencing heightened stigma and isolation. Lack of culturally and linguistically accessible information and services excludes them from on-going efforts to prevent the pandemic. The lockdown has affected refugee livelihoods and increased income insecurity, sexual and gender-based violence and anxiety. Given the paucity of government-led services to contain the epidemic, we argue that contingency planning must involve refugees and their communities to access accurate and relevant information in appropriate languages. It is also important to build the capacity of frontline workers to understand the specific needs of refugees to deliver appropriate protection in the context of the pandemic.

57. Religious construction of disease: An exploratory appraisal of religious responses to the COVID-19 pandemic in Uganda

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Journal of African Studies and Development. DOI: 10.5897/JASD2020.0573 Article Number: 3186D6D64695. Received 1 May, 2020; Accepted 30 July, 2020

ABSTRACT

This article presents empirical analysis of religious attitudes and interpretation of pandemics in Uganda. The study sought to analyze the religious explanatory models of pandemics offered by the three major religions of Uganda: Christianity, Islam and African Traditional religious belief system. The COVID-19 pandemic which ravaged the whole world, Uganda inclusive, was used as a case study. Based on a qualitative research process, the study relied on key informant interviews, media reports and online sources of information. It was established that pandemics have been part of human history. Pandemics provide an opportunity for human reflection on transcendent life since they are a challenge to science and human wisdom. Pandemics draw people closer to religion and the spiritual due to the fear, panic, and uncertainty with which they are associated. Religions are left with the responsibility of providing theological answers beyond what human beings can comprehend. The hope and trust that society has in religious institutions make them ultimate institutions to provide solace to millions of people affected with a pandemic for which scientists and politicians have no immediate answers. The study unravels the complementary role that religion and theological studies can make in understanding effective management and prevention of pandemics in society. It also adds to the continuous debate on the relationship between science and religion, arguing for the significance of religious ideas in making science effective enough to combat societal challenges like epidemics.

Keywords: Pandemics, religion, religious, construction, disease, Tondism Faith, State, science, traditional healing, coronavirus, Covid-19.

58. Predicting the Impact of COVID-19 and the Potential Impact of the Public Health Response on Disease Burden in Uganda

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ABSTRACT.

The COVID-19 pandemic and public health “lockdown” responses in sub-Saharan Africa, including Uganda, are now widely reported. Although the impact of COVID-19 on African populations has been relatively light, it is feared that redirecting focus and prioritization of health systems to fight COVID-19 may have an impact on access to non-COVID-19 diseases. We applied age-based COVID-19 mortality data from China to the population structures of Uganda and non-African countries with previously established outbreaks, comparing theoretical mortality and disability adjusted life years (DALYs) lost. We then predicted the impact of possible scenarios of the COVID-19 public health response on morbidity and mortality for HIV/AIDS, malaria, and maternal health in Uganda. Based on population age structure alone, Uganda is predicted to have a relatively low COVID-19 burden compared with an equivalent transmission in comparison countries, with 12% of the mortality and 19% of the lost DALYs predicted for an equivalent transmission in Italy. By contrast, scenarios of the impact of the public health response on malaria and HIV/AIDS predict additional disease burdens outweighing that predicted from extensive SARS-CoV-2 transmission. Emerging disease data from Uganda suggest that such deterioration may already be occurring. The results predict a relatively low COVID-19 impact on Uganda associated with its young population, with a high risk of negative impact on non-COVID-19 disease burden from a prolonged lockdown response. This may reverse hard-won gains in addressing fundamental vulnerabilities in women and children’s health, and underlines the importance of tailoring COVID-19 responses according to population structure and local disease vulnerabilities.

59. Misconceptions on COVID-19 Risk among Ugandan Men: Results From a Rapid Exploratory Survey, April 2020

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Frontiers in Public Health, 28 July 2020 | <https://doi.org/10.3389/fpubh.2020.00416>

ABSTRACT

BACKGROUND: Transmission of COVID-19 in developing countries is expected to surpass that in developed countries; however, information on community perceptions of this new disease is scarce. The aim of the study was to identify possible misconceptions among males and females toward COVID-19 in Uganda using a rapid online survey distributed *via* social media.

METHODS: A cross-sectional survey carried out in early April 2020 was conducted with 161 Ugandans, who purposively participated in the online questionnaire that assessed understandings of COVID-19 risk and infection. Sixty-four percent of respondents were male and 36% were female.

RESULTS: We found significant divergences of opinion on gendered susceptibility to COVID-19. Most female respondents considered infection risk, symptoms, severe signs, and death to be equally distributed between genders. In contrast, male respondents believed they were more at risk of infection, severe symptoms, severe signs, and death (52.7 vs. 30.6%, RR = 1.79, 95% CI: 1.14–2.8). Most women did not share this perception and disagreed that males were at higher risk of infection (by a factor of three), symptoms (79% disagree), severe signs (71%, disagree), and death (70.2% disagree). Overall, most respondents considered children less vulnerable (OR = 1.12, 95% CI: 0.55–2.2) to COVID-19 than adults, that children present with less symptoms (OR = 1.57, 95% CI: 0.77–3.19), and that there would be less mortality in children (OR = 0.92, 95%

CI: 0.41–1.88). Of female respondents, 76.4% considered mortality from COVID-19 to be different between the young and the elderly (RR = 1.7, 95% CI: 1.01–2.92) and 92.7% believed young adults would show fewer signs than the elderly, and 71.4% agreed that elderly COVID-19 patients would show more severe signs than the young (OR = 2.2, 95% CI: 1.4, 4.8). While respondents considered that all races were susceptible to the signs and symptoms of infection as well as death from COVID-19, they considered mortality would be highest among white people from Europe and the USA. Some respondents (mostly male 33/102, 32.4%) considered COVID-19 to be a “disease of whites” (30.2%).

CONCLUSION: The WHO has identified women and children in rural communities as vulnerable persons who should be given more attention in the COVID-19 national response programs across Africa; however, our study has found that men in Uganda perceive themselves to be at greater risk and that these contradictory perceptions (including the association of COVID-19 with “the white” race) suggest an important discrepancy in the communication of who is most vulnerable and *why*. Further research is urgently needed to validate and expand the results of this small exploratory study.

60. Knowledge, Attitudes, and Practices Regarding COVID-19 among Healthcare Workers in Uganda: A Cross-Sectional Survey

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ABSTRACT

Healthcare workers (HCWs) are at high risk of COVID-19. However, data on HCWs' knowledge, attitudes, and practices (KAP) toward COVID-19 are limited. Between September and November 2020, we conducted a questionnaire-based COVID-19 KAP survey among HCWs at three hospitals in Uganda. We used Bloom's cut-off of $\geq 80\%$ to determine sufficient knowledge, good attitude, and good practice, and multivariate Poisson regression with robust variance for statistical analysis. Of 717 HCWs invited to participate, 657 (91.6%) agreed and were enrolled. The mean age (standard deviation) of enrollees was 33.2 (10.2) years; most were clinical HCWs (64.7%) and had advanced secondary school/other higher-level education (57.8%). Overall, 83.9% had

sufficient knowledge, 78.4% had a positive attitude, and 37.0% had good practices toward COVID-19. Factors associated with KAP were: Knowledge: being a clinical HCW (aRR: 1.12; 95% CI: 1.02–1.23) and previous participation in health research (aRR: 1.10; 95% CI: 1.04–1.17); Attitude: age > 35 years (aRR: 0.88; 95% CI: 0.79–0.98); Practice: being a clinical HCW (aRR: 1.91; 95% CI: 1.41–2.59). HCWs in Uganda have good knowledge and positive attitude but poor practices towards COVID-19. Differences in COVID-19 KAP between clinical and non-clinical HCWs could affect uptake of COVID-19 interventions including vaccination.

Keywords: COVID-19; SARS-COV- 2; healthcare workers; knowledge; attitude; practices; Uganda

61. Long-distance truck drivers and the increasing risk of COVID-19 spread in Uganda

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International Journal of Infectious Diseases. <https://doi.org/10.1016/j.ijid.2020.06.085>. Available online 29 June 2020

ABSTRACT

OBJECTIVE: To examine the patterns of COVID-19 transmission in Uganda.

METHODS: We reviewed ten weeks of press releases from the Uganda Ministry of Health from the day when the first case was announced, March 22, through May 29, 2020. We obtained the press releases from the MoH website and the Twitter handle (@MinofHealthUG). Data include the number of persons tested and the categories were classified as international arrivals, community members, and long-distance truck drivers.

RESULTS: The first cases were international arrivals from Asia and Europe, and after that, community cases emerged. However, in the middle of April 2020, COVID-19 cases were detected among long-distance truck drivers. By May 29, 2020, 89, 224 persons had been tested; overall, 442 tested positive. Of those that tested positive, the majority, or 317 (71.8%) were truck drivers, 75 (16.9%) were community cases, and 50 (11.3%) were international arrivals. The majority of community cases have been linked to contact with truck drivers.

CONCLUSIONS: Truck drivers were the most frequently diagnosed category, and have become a core group for COVID-19 in Uganda. They have generated significant local transmission, which now threatens a full-blown epidemic unless strict controls are put in place.

62. Perspective of Medical Students on the COVID-19 Pandemic: Survey of Nine Medical Schools in Uganda

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ABSTRACT

BACKGROUND: The coronavirus disease (COVID-19) pandemic is a global public health concern affecting over 5 million people and posing a great burden on health care systems worldwide.

OBJECTIVE: The aim of this study is to determine the knowledge, attitude, and practices of medical students in Uganda on the COVID-19 pandemic.

METHODS: We conducted an online, descriptive cross-sectional study in mid-April 2020, using WhatsApp Messenger. Medical students in 9 of the 10 medical schools in Uganda were approached through convenience sampling. Bloom's cut-off of 80% was used to determine good knowledge (≥ 12 out of 15), positive attitude (≥ 20 out of 25), and good practice (≥ 12 out of 15).

RESULTS: The data of 741 first- to fifth-year medical students, consisting of 468 (63%) males with a mean age of 24 (SD 4) years, were analyzed. The majority (n=626, 84%) were pursuing Bachelor of Medicine and Bachelor of Surgery degrees. Overall, 671 (91%) had good knowledge, 550 (74%) had a positive attitude, and 426 (57%) had good practices. Knowledge was associated with the 4th year of study (adjusted odds ratio [aOR] 4.1, 95% CI 1.6-10.3; $P < .001$). Attitude was associated with the female sex (aOR 0.7, 95% CI 0.5-1; $P = .04$) and TV or radio shows (aOR 1.1, 95% CI 0.6-2.1; $P = .01$). Practices were associated with the ≥ 24 years age category (aOR 1.5, 95% CI 1.1-2.1; $P = .02$) and online courses (aOR 1.8, 95% CI 1.1-3.2; $P = .03$). In total, 592 (80%) medical students were willing to participate in frontline care if called upon.

CONCLUSIONS: Medical students in Uganda have sufficient knowledge of COVID-19 and will be a large reservoir for health care response when the need arises.

63. Effect of COVID-19 response in Uganda on street children

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ABSTRACT

Measures against COVID-19 have made drastic changes to global public health. However, they have punctuated the problems of low- and middle-income Sub-Saharan African Countries, Uganda inclusive, with already existing vulnerable populations. The limited literature on street children in Uganda emphasizes a need for their important inclusion in policy and research decisions to preserve their lives and wellbeing. This commentary has found paucity in information and research about street children and further research on this topic would bring more conclusions to the true impact of COVID-19 on street children, and thus better considerations.

64. Social Media Platforms for Health Communication and Research in the Face of COVID-19 Pandemic: A Cross Sectional Survey in Uganda.

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ABSTRACT

OBJECTIVES: (1) To examine the usage of social media and other forms of media among medical students (MS) and healthcare professionals (HCPs) in Uganda. (2) To assess the perceived usefulness of social media and other forms of media for COVID-19 public health campaigns.

DESIGN: A descriptive WhatsApp messenger-based cross-sectional survey in April 2020. Setting: Makerere University Teaching Hospitals (MUTH) and 9 of the 10 medical schools in Uganda. Participants: HCPs at MUTH and MS in the 9 medical schools in Uganda. Main outcome measures: We collected data on sociodemographic characteristics, sources of information on COVID-19, preferences of social media platform and perceived usefulness of the different media platforms for acquisition of knowledge on COVID-19.

RESULT: Overall, response rate was 21.5% for both MS and HCPs. In total, 877 (HCPs [136, 15.5%], MS [741, 85.5%]) were studied. Majority (n=555, 63.3%) were male with a median age of 24 (range: 18-66) years. Social media was a source of information for 665 (75.8%) participants. Usage was similar among MS and HCPs (565/741 (76.2%) vs. 100/136 (73.5%), p=0.5). Among the MS, commonly used social media were: WhatsApp (n=705, 95.1%) Facebook (n=405, 54.8%), Twitter (n=290, 39.1%), Instagram (n=178, 24.0) and Telegram (n=80, 10.8%). Except for WhatsApp, male MS were more likely to use the other social media platforms (p= <0.001 – 0.01). Mass media (television and radio) and social media were preferred the most useful tools for dissemination of COVID-19 related information.

CONCLUSION: More than two-thirds of MS and HCPs are routinely using social media in Uganda. Social media platforms may be used for dissemination of information as well as a research tool among MS and HCPs. Social media alongside other media platforms can also be used as sources of reliable information on COVID-19 as well as for dissemination of research findings and guidelines.

Keywords: Healthcare professionals, medical students, research, COVID-19, Uganda

65. Preparing communities to receive persons recently suspected or diagnosed with COVID-19

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ABSTRACT

Ever since the first case of COVID-19 was reported in Uganda, there are increasing number of reports of acts of discrimination and public stigmatization against rest travelers, people from areas affected by the epidemic, and those in quarantine. Unfortunately, this means that such people are

being labelled, stereotyped, discriminated and in worse situations mob justice has prevailed. It is so rejuvenating that some of our people that were recently diagnosed with COVID-19 are healing and are being discharged back home. This is a great milestone and spikes a ray of hope in our joint efforts to fight the pandemic in our country. However, there is a concern on how welcome these are into the communities. How prepared the families and communities are to receive such persons amidst the prevailing stigmatization of the disease in the public remains a very big question. A case at hand is of a 30-year-old female who returned from Kenya a few weeks back to her rented room in Kigandani village, Eastern Division in Soroti district. The surveillance team at Soroti regional referral hospital was notified of her return by the landlord and community leaders, she was picked up and put in the hospital quarantine for 14 days. In the due course, she was tested and found negative twice. Soon it was time for her to be discharged and return to the community. As a protocol here, the psychosocial team of the hospital surveillance and case management committee made a resettlement visit to the community to brief and prepare them to receive this lady prior to her discharge. From the interaction, community leaders, residents, and her landlord refused the team from discharging her back to their community in fear that she may still develop symptoms any time and infect them. They argued that she should be handed over to her family in her home village. Great resistance came from the landlord who insisted that other tenants were going to leave the rentals if this lady came back to the same rentals. It was such a trying moment for the hospital team led by the hospital's principal mental health clinician that all their efforts to explain to the community were futile. At the end of it all the lady was discharged with another colleague from quarantine who was willing to stay with her in the meantime as she contacted relatives to pick her.

CONCLUSION: This scenario sends signals of how much we need to continue sensitizing communities about COVID-19. It's therefore of great importance that all hospitals handling suspects and those with the disease consider having a prior resettlement visit for every patient or suspect to prepare the community. This is important in preventing stigma that may be projected to such persons after discharge. Media houses should also continue sensitizing the public, at times its lack of information and misinformation that breeds and propagates such stigma. Stigma could potentially contribute to more severe health problems, ongoing transmission, and jeopardizes the efforts to control the outbreak. We all have an important role to play in preventing and stopping stigma. We all need to be intentional and thoughtful of the information shared on social media and other communication platforms. There is need to ensure these are facts: stigma can be heightened by insufficient knowledge on how the disease is transmitted and treated, and how to prevent infection. Media reporting should therefore be balanced and contextualized to ensure dissemination of evidence-based information to help combat rumors and misinformation that could lead to stigmatization. Gather information at regular intervals, from WHO website and Ministry of health platforms, in order to help you distinguish facts from rumors. Facts can help to minimize fears.

66. "Everything is a Mess": How COVID-19 is Impacting Engagement with HIV Testing Services in Rural South-western Uganda

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ABSTRACT

In southwestern Uganda, where HIV prevalence among sexually active adults is ~ 7%, we have been conducting longitudinal research to improve uptake of HIV testing among communities who utilize informal health providers, such as traditional healers. On March 12, 2020, the first case of COVID-19 was described in eastern Africa. Shortly thereafter, Ugandan President Museveni enacted countrywide ordinances to mitigate the spread of the disease. These restrictions included suspension of public gatherings, closure of schools and non-essential business, discontinuation of public transportation, and enforcement of a national curfew. At the time of these regulations, our study was conducting scheduled 90-day follow up interviews among participants referred for voluntary HIV testing at the District regional referral hospital. In this Note from the Field, we present data from 20 in-depth interviews conducted between April and May 2020 describing the impact of COVID-19 on uptake of HIV testing in southwestern Uganda. We believe the experiences of our participants may be representative of other rural, HIV-endemic regions of sub-Saharan Africa.

67. COVID-19 pandemic, Uganda's story

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ABSTRACT

As the COVID-19 pandemic continues to ravage health care systems, economies, livelihoods, and cultures across the world, responses across countries have varied greatly. Uganda adopted its own model taking into consideration its culture, values, environment, socio-economic activities, beliefs, previous successful epidemic experience, and appears a hybrid policy to the Norwegian model. This model of response is perhaps based on Uganda's long experience in successful control of many previous epidemics which afflicted it and the neighboring countries, e.g, HIV and AIDs in the 1980s, Measles in the 1990s, Hepatitis B in the 2000s, Ebola in 2000, 2017 and 2018

and Marburg in 2018. In our view the near complete lockdown through shutting down air, road, water travels and congregate settings as well as the restriction of people's movement through the stay home policy may have, so far, played a significant role in this pandemic containment and control. Most notable is that there is an established and clear leadership structure, experienced health workforce, good political will, enabling environment, and good epidemic response by the population. Even though one can reasonably argue that the numbers of COVID-19 cases seen in Uganda so far, are not anywhere close to those large numbers seen in the USA, Asia and other European countries, Uganda's story on how it is managing the pandemic is worth sharing as it might provide useful lessons for future public health interventions to a pandemic of this magnitude, particularly in low-resource settings. Uganda's President continued to provide national leadership, guidance, and coordination to the COVID-19 National task force for the response. The President and Ministry of Health authorities employed both electronic and social media such as radios, music, Televisions, SMS messages, twitters, group emails, and WhatsApp messages to engage, mobilize, and sensitize the population on COVID-19 preventive interventions through provision of regular updates. In conclusion, simultaneous multiple public health interventions through a structured leadership may in part contribute to reasonable and timely control of a pandemic such as COVID-19.

Keywords: COVID-19, Uganda, response, leadership, multiple public health interventions

68. Uganda's First 100 COVID-19 Cases: Trends and Lessons

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ABSTRACT

Coronavirus disease -2019 (COVID-19) continues to hit-hard on many countries across the world. Uganda reported its first case of COVID-19 on the March 21, 2020. A 36-year-old businessman from Kampala, Uganda's capital, who had travelled to Dubai, United Arab Emirates (UAE) in a healthy condition four days prior to his return. He presented with fever and flu-like symptoms at Entebbe International Airport (EIA) and his sample tested positive for SARS-CoV-2, the causative agent of COVID-19. Consequently, individuals who had been to UAE two weeks prior to the first case were traced by Ministry of Health (MoH) Uganda and subjected to institutional quarantine. In the following two weeks (March 21 to April 5), there was a rapid rise in the number of cases to 52, most of whom were imported cases from institutional quarantine. The epidemiologic curve had flattened between April 5 to April 19. However, we observed a second upsurge in incident

cases during the late April and early May ultimately reaching 100 cases on May 6, 2020. Of these, 89 cases (89%) were imported, 8 (8%) local transmissions and 3 (3%) with unknown chain of transmission. Majority of the cases were truck drivers (40, 40%) from Kenya (21) and Tanzania (14) with 3 Ugandans, 1 Eritrean and 1 Burundian. The truck drivers transit through Uganda, carrying cargo to or from neighbouring countries who have all recorded rises in cases of late. In addition to the truck drivers, two cases of local transmission have been reported among Uganda Police Force officers, which may indicate an on-going community transmission of COVID-19. Uganda has to date largely been able to achieve control of local transmission through lockdown, massive testing of people in quarantine, country's borders and their contacts in addition to public health campaigns. Testing of truck drivers at the borders commenced on April 10th, 2020. MoH Uganda also commissioned Journal Pre-proof 3 community testing to establish the status of local transmission on the April 28, 2020. As of 7th May 2020, 55 cases have recovered and have been discharged home, 45 are receiving treatment and no recorded deaths. Whereas Uganda is in a lockdown with no public and private transport allowed, cargo planes and trucks have been allowed to move. Of great threat are truck drivers who have rest points (lodges, eating places and fuel stations) along the journey and interact with a number of local Ugandans. MoH-Uganda has put measures like testing drivers at all border points but they are left to continue with the journey until pronounced positive, tracked and taken to treatment centres. Hospitality staffs and security personnel along these routes are at a high risk of infection. It is of immense importance that all the East African countries work together to ensure there are no contact between these drivers and the community; and if unavoidable, preventive measures prescribed by WHO are put in place. In addition, introduction of rapid point of care testing cannot be overemphasized, especially at the border points to reduce the long turnaround time and guide decision-making.

69. COVID-19 in Uganda: Epidemiology and Response

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ABSTRACT

Uganda has had a relatively large share of zoonotic disease outbreaks in the past and this has impacted its preparedness and response level in combatting the COVID-19 outbreak in the country. Compared to most countries in the East African Community, Africa and the world, Uganda seems to be effectively curtailing the spread of the virus and managing the disease despite its relatively weak healthcare system and economy. The first COVID-19 case was confirmed on March 21st, 2020 and as at May 6th, 2020, there has only been 100 cases confirmed

from 47,620 tests carried out. Also, as at this date, there has been 55 recoveries and no reported death from the disease. These promising statistics prompts the development of this paper to detail the epidemiology of the disease in the country and discuss the response of the government and other stakeholders to the outbreak.

Keywords: Coronavirus, Uganda, epidemiology

70. Continuity of health service delivery during the COVID-19 pandemic: the role of digital health technologies in Uganda

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ABSTRACT

In response to coronavirus disease-2019 pandemic (COVID-19), the government of Uganda instituted movement restrictions to curb disease spread. However, this affected accessibility to medical services in a setting where the healthcare system is not equipped to handle most healthcare needs of the populace outside hospital premises. This gap led to the prominence and unprecedented rise in the use of digital health technologies to deliver health information and services at a distance (telehealth) during the COVID-19 outbreak. The use of telehealth modalities including tele-consultation, tele-psychiatry, call centers and mobile phone health information dissemination increased. The COVID-19 pandemic augmented the rising role of digital health technologies as a much needed aspect of medical service delivery in our times. However, the efficacy and impact on clinical outcomes across various healthcare thematic areas need to be explored further and more evidence generated.

73. Projection Of Covid–19 Pandemic In Uganda

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ABSTRACT

COVID–19 (Corona Virus) is caused by Severe Acute Respiratory Syndrome Corona Virus 2 (SARS–COV–2). The virus that was first discovered in China Wuhan Province about 3 months ago (first cases were reported in Wuhan on December 31st 2019) has spread worldwide. The six (6) top countries (excluding China) most affected so far include; USA, Italy, Spain, Germany, France and Iran. With Italy showing the highest death toll. In Uganda where it was discovered on 19/3/2020 with one (01) case has just in nine (9) days, increased to thirty (30) infected individuals. This model is a wake up call over the rate at which COVID–19 is likely to spread throughout the country. Thus it is a guide for policymakers and planners to benchmark on for solutions to this deadly virus.

Keywords: COVID–19, Awareness, Infection rate, Pneumonia

74. Migration and Immigration: Uganda and the COVID-19 Pandemic

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ABSTRACT

COVID-19 has proven that all human beings on the move—rich or poor—are vulnerable to disease. And now, COVID-19 has disrupted migration, stopping it all together in most parts of the world. Planes are grounded, borders closed, and many countries are under lockdown. This time of stillness, of staying put, is an opportunity to improve migration policies and efforts, including in Uganda. Uganda's first case of COVID-19 arrived on March 22. Within a week there were 44 cases, and the figure is steadily increasing. Although Uganda's cases are still minimal, the president instituted a countrywide lockdown on March 30. Based on what is now known from experiences in hardest hit Countries like China, Italy, Spain and USA, preparations should come early, even when a country has not registered a case. After all, disease knows no borders and it is only a matter of time before it spreads. In most of Africa, including Uganda, these preparations should have started a decade ago, however. For so long, governments and development partners have concentrated their efforts to curbing illegal migration, transnational organized crimes like terrorism, trafficking and smuggling of persons, drugs and arms. These challenges deserve the attention and resources, but COVID-19 is a reminder that all aspects of Migration deserve attention, including Migration health. There is currently no unifying global definition for Migration Health. To the International Organization for Migration (IOM), it encompasses the physical, mental and social well-being of migrants, enabling them and host communities to achieve social and economic development

75. Adoption of COVID-19 triage strategies for low-income settings

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ABSTRACT

Despite major advances in epidemic preparedness, Africa remains uniquely susceptible to novel coronavirus disease 2019 (COVID-19). According to the Infectious Disease Vulnerability Index, 22 of the 25 countries most susceptible to an infectious disease outbreak are in Africa. The high prevalence of HIV, tuberculosis, and other pathogens might potentiate the severity of COVID-19 and contribute to diagnostic uncertainty. Health-care systems and human resources are already spread thin. And although the young age of the population (with more than half aged younger than 20 years) might prove protective, it also means that Africa has much to lose in terms of disability adjusted life years. On Feb 27, 2020, the first case of COVID-19 in sub-Saharan Africa was reported in Nigeria, making spread in the region more probable. While preparing a response to COVID-19 outbreak in Uganda, we read Jinnong Zhang and colleagues' work with great interest. We commend the authors for distilling complex information regarding triage and clinical care for patients who have a novel pathogen, for which there is little evidence, into a succinct flowchart. Unfortunately, many aspects of their algorithm would not be feasible in our setting. Chest CT, complete blood counts with differential, and C-reactive protein are all central to their algorithm, and none are routinely available in Uganda. To train front-line health workers in Uganda to triage patients effectively, we propose a modified COVID-19 screening algorithm (figure) for use in resource-limited settings that do not have established local transmission. Our algorithm triages patients initially on the basis of fever (subjective or measured) or cough—symptoms that are near ubiquitous among patients with COVID-19. If these symptoms are combined with epidemiological risk, then patients are isolated, appropriate infection prevention and control measures are implemented, and testing for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is initiated. This approach is simple and uses readily available technology. The most advanced tool required is a thermometer. Elimination of chest imaging is an important departure of our proposed approach. Although an important part of clinical care, we could not envision a situation in which chest x-ray findings would change who was prioritised for testing. Furthermore, chest x-ray is not available at a large proportion of health facilities in Uganda, and we did not want to ask health workers to navigate an impossible flowchart. Our algorithm is not intended to lead the health worker to every possible diagnosis. Rather, it is meant to be a rapid and simple tool to decide who requires isolation and targeted testing for SARS-CoV-2. Tuberculosis and community-acquired pneumonia are particularly common in this setting and their presentation could easily mimic COVID-19. The astute clinician should consider these and other disease processes as part of a comprehensive clinical evaluation. The rapid pace of

information means that the ideal approach is likely to change over the coming weeks. Should SARS-CoV-2 continue to spread, the utility of an epidemiological risk question will rapidly fade. For now, we hope this is a simple and reasonable approach that will be helpful for other countries in our region as they prepare for what is to come.

76. Contact Tracing and the COVID-19 Response in Africa: Best Practices, Key Challenges, and Lessons Learned from Nigeria, Rwanda, South Africa, and Uganda

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ABSTRACT

Most African countries have recorded relatively lower COVID-19 burdens than Western countries. This has been attributed to early and strong political commitment and robust implementation of public health measures, such as nationwide lockdowns, travel restrictions, face mask wearing, testing, contact tracing, and isolation, along with community education and engagement. Other factors include the younger population age strata and hypothesized but yet-to-be confirmed partially protective cross-immunity from parasitic diseases and/or other circulating coronaviruses. However, the true burden may also be underestimated due to operational and resource issues for COVID-19 case identification and reporting. In this perspective article, we discuss selected best practices and challenges with COVID-19 contact tracing in Nigeria, Rwanda, South Africa, and Uganda. Best practices from these country case studies include sustained, multi-platform public communications; leveraging of technology innovations; applied public health expertise; deployment of community health workers; and robust community engagement. Challenges include an overwhelming workload of contact tracing and case detection for healthcare workers, misinformation and stigma, and poorly sustained adherence to isolation and quarantine. Important lessons learned include the need for decentralization of contact tracing to the lowest geographic levels of surveillance, rigorous use of data and technology to improve decision-making, and sustainment of both community sensitization and political commitment. Further research is needed to understand the role and importance of contact tracing in controlling community transmission dynamics in African countries, including among children. Also, implementation science will be critically needed to evaluate innovative, accessible, and cost-effective digital solutions to accommodate the contact tracing workload.

77. HIV and SARS-CoV-2 co-infection: A case report from Uganda

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ABSTRACT

There are no reports of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and HIV co-infection from sub-Saharan Africa where 70% of people living with HIV are found. We report a

case of HIV/SARS-CoV-2 co-infection from Uganda. A 34 year old HIV-positive female on antiretroviral therapy (tenofovir disoproxil fumarate, lamivudine and efavirenz) for 5 years, tested positive for SARS-CoV-2, the causative agent for coronavirus disease 19 (COVID-19). She was asymptomatic at presentation but subsequently developed headache, chest pain, diarrhoea, anorexia and fatigue on day 3 of isolation without cough, fever or shortness of breath. Her CD4 count was 965 cells/mm³, the HIV viral load was undetectable (<1,000 cells/mm³) and other laboratory work up was normal. She was successfully managed with hydroxychloroquine and broad spectrum antibiotics, and was discharged after 24 days. This case demonstrates an atypical clinical presentation of COVID – 19 in an HIV infected patient without other co-morbidity.

Keywords: COVID-19, HIV, SARS-CoV-2, Uganda

78. A SARS-CoV-2 lineage A variant (A.23.1) with altered spike has emerged and is 2 dominating the current Uganda epidemic

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ABSTRACT

The Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) was first detected in March 2020 in Uganda. Recently the epidemic showed a shift of SARS-CoV-2 variant distribution and we report here newly emerging A sub-lineages, A.23 and A.23.1, encoding replacements in the spike protein, nsp6, ORF8 and ORF9, with A.23.1 the major virus lineage now observed in Kampala. Although the clinical impact of the A.23.1 variant is not yet clear it is essential to continue careful monitoring of this variant, as well as rapid assessment of the consequences of the spike protein changes for vaccine efficacy.

Keywords: SARS-CoV-2, new variant, A.23; A.23.1, spike protein changes

79. Differential Performance of CoronaCHEK SARS-CoV-2 Lateral Flow Antibody Assay by Geographic Origin of Samples

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ABSTRACT

We assessed the performance of the CoronaCHEK lateral flow assay on samples from Uganda and Baltimore to determine the impact of geographic origin on assay performance. Plasma samples from severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) PCR-positive individuals (Uganda, 78 samples from 78 individuals, and Baltimore, 266 samples from 38 individuals) and from prepandemic individuals (Uganda, 1,077, and Baltimore, 532) were evaluated. Prevalence ratios (PR) were calculated to identify factors associated with a false-positive test. After the first positive PCR in Ugandan samples, the sensitivity was 45% (95% confidence interval [CI], 24,68) at 0 to 7 days, 79% (95% CI, 64 to 91) at 8 to 14 days, and 76% (95% CI, 50 to 93) at .15 days. In samples from Baltimore, sensitivity was 39% (95% CI, 30 to 49) at 0 to 7 days, 86% (95% CI, 79 to 92) at 8 to 14 days, and 100% (95% CI, 89 to 100) at 15 days after positive PCR. The specificity of 96.5% (95% CI, 97.5 to 95.2) in Ugandan samples was significantly lower than that in samples from Baltimore, 99.3% (95% CI, 98.1 to 99.8; P, 0.01). In Ugandan samples, individuals with a false-positive result were more likely to be male (PR, 2.04; 95% CI, 1.03,3.69) or individuals who had had a fever more than a month prior to sample acquisition (PR, 2.87; 95% CI, 1.12 to 7.35). Sensitivity of the CoronaCHEK was similar in samples from Uganda and Baltimore. The specificity was significantly lower in Ugandan samples than in Baltimore samples. False-positive results in Ugandan samples appear to correlate with a recent history of a febrile illness, potentially indicative of a cross-reactive immune response in individuals from East Africa.

KEYWORDS: lateral flow antibody assay, SARS-CoV-2, Uganda, assay performance

80. Differential pre-pandemic IgA reactivity against SARS-CoV-2 and circulating human coronaviruses measured in milk collected in Uganda and the USA

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ABSTRACT

OBJECTIVE: Uganda, like other African countries, has registered fewer COVID-19 cases and deaths per capita than non-African countries. The lower numbers of cases and deaths in Uganda might be due to pre-existing cross-immunity induced by zoonotic coronaviruses or circulating common cold human coronaviruses (HCoVs) before the COVID-19 pandemic. In order to test this premise, we compared IgA reactivity to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and HCoVs in breast milk of US and rural Ugandan mothers collected in 2018 before the COVID-19 epidemic. Ugandan and US pre-pandemic breast milk samples were run in duplicate on enzyme-linked immunoadsorbent assay (ELISA) to measure specific IgA antibody reactivity to the spike proteins of SARS-CoV-2, human coronaviruses (HCoV) NL63, OC43, HKU1, and 229E. Pooled plasma from US COVID-19 positive and negative cases were employed as positive and negative controls, respectively. One Ugandan pre-pandemic milk sample had remarkably high reactivity against all HCoVs and SARS-CoV-2 spike proteins. There was higher IgA reactivity against the betacoronavirus HCoV-OC43 in Ugandan pre-pandemic milk samples by comparison with US pre-pandemic milk samples ($p = 0.018$). By contrast, there was significantly higher IgA reactivity against the alphacoronaviruses HCoV229E and HCoV-NL63 in US pre-pandemic milk samples by comparison with Ugandan pre-pandemic milk samples ($p < 0.0001$ and 0.035 , respectively).

CONCLUSION: Some Ugandan mothers may have robust pre-existing immunity against SARS-CoV-2 due to cross-immunity induced by HCoVs which may be passed on to their infants via breastfeeding. The differential pre-pandemic reactivity of US mothers to HCoV 229E and HCoV NL63 may have contributed to suboptimal antibody responses to SARS-CoV-2.

81. The Ugandan Severe Acute Respiratory Syndrome -Coronavirus 2 (SARS-CoV-2) Model: A Data Driven Approach to Estimate Risk

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ABSTRACT

OBJECTIVES: The first case of Severe Acute Respiratory Syndrome-Coronavirus 2 (SARS-CoV-2) was identified on March 21, 2020, in Uganda. The number of cases increased to 8,287 by September 30, 2020. By May throughout June, most of the cases were predominantly imported cases of truck drivers from neighbouring countries. Uganda responded with various restrictions and interventions including lockdown, physical distancing, hand hygiene, and use of face masks in public, to control the growth rate of the outbreak. By end of September 2020, Uganda had transitioned into community transmissions and most of the reported cases were locals contacts and alerts. This study assessed risks associated with SARS-CoV-2 in Uganda, and presents estimates of the reproduction ratio in real time. An optimal control analysis was performed to determine how long the current mitigation measures such as controlling the exposure in communities, rapid detection, confirmation and contact tracing, partial lockdown of the vulnerable groups and control at the porous borders, could be implemented and at what cost.

METHODS: The daily confirmed cases of SARS-CoV-2 in Uganda were extracted from publicly available sources. Using the data, relative risks for age, gender, and geographical location were determined. Four approaches were used to forecast SARS-CoV-2 in Uganda namely linear exponential, nonlinear exponential, logistic and a deterministic model. The discrete logistic model and the next generation matrix method were used to estimate the effective reproduction number.

RESULTS: Results showed that women were at a higher risk of acquiring SARS-CoV-2 than the men, and the population attributable risk of SARS-CoV-2 to women was 42.22%. Most of the women affected by SARS-CoV-2 were likely contacts of cargo truck drivers at the borders, where high infection rates were reported. Although most deaths in Uganda were in the age group of 60-69, the highest case fatality rate per 1000 was attributable the age group of 80-89, followed by 70-79. Geographically, Amuru had the highest relative risk compared to the national risk to SARS-CoV-2. For the case of mitigation scenarios, washing hands with 70% compliance and regular hand washing of 6 times a day, was the most effective and sustainable to reduce SARSCoV-2 exposure. This was followed by public wearing of face masks if at least 60% of the population complied, and physical distancing by 60% of the population. If schools, bars and churches were opened without compliance, i.e., no distancing, no handwashing and no public wearing of face masks, to mitigation measures, the highest incidence was observed, leading to a big replacement number. If mitigation measures are not followed by the population, then there will be high incidences and prevalence of the virus in the population.

82. Whole-genome sequencing of SARS-CoV-2 in Uganda: implementation of the low-cost ARTIC protocol in resource-limited settings

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ABSTRACT

BACKGROUND: In January 2020, a previously unknown coronavirus strain was identified as the cause of a severe acute respiratory syndrome (SARS-CoV-2). The first viral whole-genome was sequenced using high-throughput sequencing from a sample collected in Wuhan, China. Whole-genome sequencing (WGS) is imperative in investigating disease outbreak transmission dynamics and guiding decision-making in public health.

METHODS: We retrieved archived SARS-CoV-2 samples at the Integrated Biorepository of H3Africa Uganda, Makerere University (IBRH3AU). These samples were collected previously from individuals diagnosed with coronavirus disease 2019 (COVID-19) using real-time reverse transcription quantitative polymerase chain reaction (RTqPCR). 30 samples with cycle thresholds (Cts) values <25 were selected for WGS using SARS-CoV-2 ARTIC protocol at Makerere University Molecular Diagnostics Laboratory.

RESULTS: 28 out of 30 (93.3%) samples generated analyzable genomic sequence reads. We detected SARS-CoV-2 and lineages A (22/28) and B (6/28) from the samples. We further show phylogenetic relatedness of these isolates alongside other 328 Uganda (lineage A = 222, lineage B = 106) SARS-CoV-2 genomes available in GISAID by April 22, 2021 and submitted by the Uganda Virus Research Institute.

CONCLUSIONS: Our study demonstrated adoption and optimization of the low-cost ARTIC SARS-CoV-2 WGS protocol in a resource limited laboratory setting. This work has set a foundation to enable rapid expansion of SARS-CoV-2 WGS in Uganda as part of the Presidential Scientific Initiative on Epidemics (PRESIDE) CoV-bank project and IBRH3AU.

Keywords: COVID-19, Makerere University, Uganda, SARS-CoV-2, Whole-genome sequencing, PRESIDE, RT-PCR

83. Evaluation of the performance of 25 SARS-CoV-2 serological rapid diagnostic tests using a reference panel of plasma specimens at the Uganda Virus Research Institute

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International Journal of Infectious Diseases; <https://doi.org/10.1016/j.ijid.2021.09.020>

ABSTRACT

INTRODUCTION: Serological testing is needed to better understand the epidemiology of the SARS-CoV-2 virus. Rapid Diagnostic Tests (RDTs) have been developed to detect specific antibodies, IgM and IgG, to the virus. We evaluated the performance of 25 of these RDTs.

METHODS: A serological reference panel of 50 positive and 100 negative plasma specimens was developed from SARS-CoV-2 PCR and antibody positive patients and pre-pandemic SARS-CoV-2-negative specimens collected in 2016. Test performance of the 25 RDTs was evaluated against this panel.

RESULTS: A total of 10 RDTs had a sensitivity $\geq 98\%$ while 13 RDTs had a specificity $\geq 98\%$ to anti-SARS-CoV-2 IgG antibodies. Four RDTs; Boson, MultiG, Standard Q and ViviaDiag had both sensitivity and specificity of $\geq 98\%$ to anti-SARS-CoV-2 IgG antibodies. Only 3 RDTs had a sensitivity $\geq 98\%$ while 10 RDTs had a specificity $\geq 98\%$ to anti-SARS-CoV-2 IgM antibodies. Three RDTs; Autobio, MultiG and Standard Q, had sensitivity and specificity of $\geq 98\%$ to combined IgG/IgM. The RDTs that performed well also had perfect or almost perfect inter-reader agreement.

CONCLUSIONS: This evaluation identified three RDTs with a sensitivity and specificity to IgM/IgG antibodies of $\geq 98\%$ with the potential for widespread antibody testing in Uganda.

84. Estimating the Effect and Cost-Effectiveness of Facemasks in Reducing the Spread of the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) in Uganda

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ABSTRACT

Evidence that face masks provide effective protection against respiratory infections in the community is scarce. However, face masks are widely used by health workers as part of droplet precautions when caring for patients with respiratory infections. It would therefore be reasonable to suggest that consistent widespread use of face masks in the community could prevent further spread of the Severe Acute Respiratory Syndrome-Coronavirus 2 (SARSCoV-2). In this study we examine public face mask wearing in Uganda where a proportion wears masks to protect against acquiring, and the other to prevent from transmitting SARSCoV-2. The objective of this study was to determine what percentage of the population would have to wear face masks to reduce susceptibility to and infectivity of SARS-COV-2 in Uganda, keeping the basic reproduction number below unity and/or flattening the curve. We used an SEIAQRD model for the analysis. Results show that implementation of facemasks has a relatively large impact on the size of the coronavirus epidemic in Uganda. We find that the critical mask adherence is 5 per 100 when 80% wear face masks. A cost-effective analysis shows that utilizing funds to provide 1 public mask to the population has a per capita compounded cost of USD 1.34. If provision of face masks is done simultaneously with supportive care, the per capita compounded cost is USD 1.965, while for the case of only treatment and no provision of face masks costs each Ugandan USD 4.0579. We conclude that since it is hard to achieve a 100% adherence to face masks, government might consider provision of face masks in conjunction with provision of care.

85. Coronavirus Disease 2019 (COVID-19) Mitigation Efforts and Testing During an In-Person Training Event—Uganda, 12–29 October 2020

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ABSTRACT

Large public-health training events may result in severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) transmission. Universal SARS-CoV-2 testing during trainings for the Uganda Population-based HIV Impact Assessment identified 28 of 475 (5.9%) individuals with coronavirus disease 2019 (COVID-19) among attendees; most (89.3%) were asymptomatic. Until COVID-19 vaccine is readily available for staff and participants, effective COVID-19 mitigation measures, along with SARS-CoV-2 testing, are recommended for in-person trainings, particularly when trainees will have subsequent contact with survey participants. **Keywords.** SARS-CoV-2; COVID-19; mitigation; testing; trainings.

86. Biobanking: Strengthening Uganda's Rapid Response to COVID-19 and Other Epidemics

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ABSTRACT

INTRODUCTION: SARS-CoV-2 is a fatal disease of global public health concern. Measures to reduce its spread critically depend on timely and accurate diagnosis of virus-infected individuals. Biobanks can have a pivotal role in elucidating disease etiology, translation, and advancing public health. In this article, we show how a biobank has been a critical resource in the rapid response to coronavirus disease of 2019 (COVID-19) in Uganda.

MATERIALS AND METHODS: The Integrated Biorepository of H3Africa Uganda established a COVID-19 biobank. Standard Operating Procedures for sample and data collection, sample processing, and storage were developed. An e-questionnaire data tool was used to collect

sociodemographic factors. Samples were collected at 7-day intervals from patients, analyzed for key parameters, processed, annotated, characterized, and stored at appropriate temperatures. RESULTS: Stored samples have been used in validation of 17 diagnostic kits, the Cepheid Xpert Xpress SARSCoV-2 assay, as well as a sample pooling technique for mass screening and polymerase chain reaction assay validation. Kits that passed validation were deployed for mass screening boosting early detection, isolation, and treatment of COVID-19 cases. Also, 10 applications from researchers and biotech companies have been received and approved and 4 grants have been awarded

CONCLUSION: The CoV-Bank has proven to be an invaluable resource in the fight against the COVID-19 pandemic in Uganda, as samples have been resources in the validation and development of COVID-19 diagnostic tools, which are important in tracing and isolation of infected cases to confront, delay, and stop the spread of the SARS-CoV-2 virus.

Keywords: biobanking, COVID-19, pandemic, diagnostics, rapid response

87. Seroprevalence of human coronaviruses among patients visiting hospital-based sentinel sites in Uganda

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ABSTRACT

BACKGROUND: Human coronaviruses are causative agents of respiratory infections with several subtypes being prevalent worldwide. They cause respiratory illnesses of varying severity and have been described to be continuously emerging but their prevalence is not well documented in Uganda. This study assessed the seroprevalence of antibodies against the previously known human coronaviruses prior 2019 in Uganda.

METHODS: A total 377 serum samples collected from volunteers that showed influenza like illness in five hospital based sentinel sites and archived were analyzed using a commercial Qualitative Human Coronavirus Antibody IgG ELISA kit. Although there is no single kit available that can detect the presence of all the circulating coronaviruses, this kit uses a nucleoprotein, aa 340–390 to coat the wells and since there is significant homology among the various human coronavirus strains with regards to the coded for proteins, there is significant cross reactivity beyond HCoV HKU-39849 2003. This gives the kit a qualitative ability to detect the presence of human coronavirus antibodies in a sample.

RESULTS: The overall seroprevalence for all the sites was 87.53% with no significant difference in the seroprevalence between the Hospital based sentinel sites ($p = 0.8$). Of the seropositive, the age group 1–5 years had the highest percentage (46.97), followed by 6–10 years (16.67) and then above 20 (16.36). An odds ratio of 1.6 (CI 0.863–2.97, $p = 0.136$) showed that those volunteers below 5 years of age were more likely to be seropositive compared to those above 5 years. The seropositivity was generally high throughout the year with highest being recorded in March and the lowest in February and December.

CONCLUSIONS: The seroprevalence of Human coronaviruses is alarmingly high which calls for need to identify and characterize the circulating coronavirus strains so as to guide policy on the control strategies.

Keywords: Human coronaviruses, Febrile illnesses, Emerging viral infections, Seroprevalence

88. University Lecturers and Students Could Help in Community Education About SARS-CoV-2 Infection in Uganda

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ABSTRACT

BACKGROUND: The World Health Organization has placed a lot of attention on vulnerable communities of Africa due to their chronically weak health care systems. Recent findings from Uganda show that medical staff members have sufficient knowledge but poor attitudes toward coronavirus disease 2019 (COVID-19) pandemic.

AIM: The aim of this study was to determine the knowledge, attitudes, and preparedness/practices of lecturers and students in the fight against COVID-19.

METHOD: This was a descriptive cross-sectional study of 103 lecturers and students both men and women of age group 18 to 69 years in western Uganda. Data were obtained through a pretested questionnaire availed online.

RESULTS: Knowledge on COVID-19 symptoms was highest in this order: fever > dry cough > difficulty breathing > fatigue > headache with no significant differences between lecturers and students. Knowledge of participants on transmission of COVID-19 was highest in the order of cough drops > contaminated surfaces > person-to-person contact > asymptomatic persons > airborne > zoonotic with no significant differences among lecturers and students. Lecturers and students were all willing to continue using personal protective equipment like masks, and personal practices such as covering the mouth while sneezing and coughing, no handshaking, and washing of hands with no significant differences in the responses. The positive attitudes that COVID-19 could kill, anyone can get COVID-19, and willing to abide by the set regulations against the pandemic showed personal concerns and desired efforts against COVID-19.

CONCLUSION: The study identifies lecturers and students as potential stakeholders in the fight against community transmission of COVID-19.

Keywords: COVID-19, SARS-CoV-2, coronavirus, community education, lecturers, students, western Uganda

89. Antibiotic Prescription Rationality And Associated In-Patient Treatment Outcomes In Children Under-Five With Severe Pneumonia At Bwizibwera Health Center IV, Mbarara District, South-Western Uganda

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ABSTRACT

BACKGROUND: Pneumonia is a major cause of morbidity and mortality in children under five. Antibiotic treatment must be started immediately in children with pneumonia. The irrational use of antibiotics may increase morbidity and mortality in children with pneumonia. Pneumonia accounted for approximately 16 % of the 5.6 million under-five deaths world wide in 2016. In Uganda, it kills approximately 2,400 children per year. Early diagnosis and appropriate case management with rational use of antibiotics remain the most effective intervention to reduce

pneumonia-related mortality. This study aimed at determining antibiotic prescription rationality and associated in-patient treatment outcomes in children aged 2-59 months with severe community-acquired pneumonia at Bwizibwera Health Centre IV from 1 st May 2018 to 30 th April 2019.

METHODS: We conducted a retrospective cohort design; data were collected from in-patient records of all children aged 2-59 months with severe community-acquired pneumonia who met the eligibility criteria for a period of one year. Data abstraction template was used for data collection. Health care records of children aged 2-59 months who had other co-morbidities and were on medication that could influence or impact on in-patient treatment outcomes from 1st May 2018 to 30th April 2019 were excluded. Data was entered and analyzed using Epi-info v 7.2 and STATA v 13.0 respectively, Descriptive statistics were reported and Chi-square test was used to compare the proportions.

RESULTS: Of the total records of children retrieved and screened (N = 847), 229 prescription records of children fulfilled inclusion criteria, 57 (24.9 %) had rational prescriptions with good outcomes and 172 (75.1 %) had irrational prescriptions with 10 (4.4 %) having unfavorable outcomes. The majority (73.7 %) of those who received rational prescription were on treatment with a combination of benzyl penicillin plus gentamycin while (26.3 %) were on ampicillin plus gentamycin. The majority (32.4 %) of patients with good treatment outcomes were aged 6 – 11 months. This age category also doubled as the group that experienced the highest percentage (40.0 %) of unfavorable outcomes.

CONCLUSION: The majority of children 172 (75.1%) had received irrational antibiotic prescriptions. There were no statistically significant associations between patient characteristics and treatment outcomes.

Keywords: Antibiotic, Children, Rationality, Pneumonia, Prescription, Treatment outcomes, Bwizibwera, Health center IV.

90. Appropriateness of Care for Common Childhood Infections at Low-Level Private Health Facilities in a Rural District in Western Uganda

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ABSTRACT:

In Uganda, >50% of sick children receive treatment from primary level-private health facilities (HF). We assessed the appropriateness of care for common infections in under-five-year-old children and explored perspectives of healthcare workers (HCW) and policymakers on the quality of healthcare at low-level private health facilities (LLPHF) in western Uganda. This was a mixed-methods parallel convergent study. Employing multistage consecutive sampling, we selected 110 HF and observed HCW conduct 777 consultations of children with pneumonia, malaria, diarrhea or neonatal infections. We purposively selected 30 HCW and 8 policymakers for in-depth interviews. Care was considered appropriate if assessment, diagnosis, and treatment were correct. We used uni-variable and multivariable logistic regression analyses for quantitative data and deductive thematic analysis for qualitative data. The proportion of appropriate care was 11% for pneumonia, 14% for malaria, 8% for diarrhea, and 0% for neonatal infections. Children with danger signs were more likely to receive appropriate care. Children with diarrhea or ability to feed orally were likely to receive inappropriate care. Qualitative data confirmed care given as often inappropriate, due to failure to follow guidelines. Overall, sick children with common infections were inappropriately managed at LLPHF. Technical support and provision of clinical guidelines should be increased to LLPHF.

Keywords: appropriate healthcare; primary level; private; paediatrics; infections

91. Effectiveness of peer-supervision on pediatric fever illness treatment among registered private drug sellers in East-Central Uganda: An interrupted time series analysis

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ABSTRACT

RATIONALE, AIMS, AND OBJECTIVES: Appropriate treatment of pediatric fever in rural areas remains a challenge and maybe partly due to inadequate supervision of licensed drug sellers. This study assessed the effectiveness of peer-supervision among drug sellers on the appropriate treatment of pneumonia symptoms, uncomplicated malaria, and non-bloody diarrhea among children less than 5 years of age in the intervention (Luuka) and comparison (Buyende) districts, in East-Central Uganda.

METHODS: Data on pneumonia symptoms, uncomplicated malaria, and non-bloody diarrhea among children less than 5 years of age was abstracted from drug shop sick child registers over a 12-month period; 6 months before and 6 months after the introduction of peer-supervision. Interrupted time series were applied to determine the effectiveness of the peer-supervision intervention on the appropriate treatment of pneumonia, uncomplicated malaria, and non-bloody diarrhea among children less than 5 years of age attending drug shops in East Central Uganda.

RESULTS: The proportion of children treated appropriately for pneumonia symptoms was 10.84% ($P < .05$, CI = [1.75, 19.9]) higher, for uncomplicated malaria was 1.46% ($P = .79$, CI = [10.43, 13.36]) higher, and for non-bloody diarrhea was 4.00% ($P < .05$, CI = [-7.95, 0.13]) lower in the intervention district than the comparison district, respectively. Post-intervention trend results showed an increase of 1.21% ($P = .008$, CI = [0.36, 2.05]) in the proportion appropriately treated for pneumonia symptoms, no difference in appropriate treatment for uncomplicated malaria, and a reduction of 1% ($P < .06$, CI = [-1.95, 0.02]) in the proportion of children appropriately treated for non-bloody diarrhea, respectively.

CONCLUSIONS: Peer-supervision increased the proportion of children less than 5 years of age that received appropriate treatment for pneumonia symptoms but not for uncomplicated malaria and non-bloody diarrhea. Implementation of community-level interventions to improve pediatric fever management should consider including peer-supervision among drug sellers.

Keywords: appropriate treatment, childhood illnesses, interrupted time series, peer-supervision, Uganda.

92. Estimated Cost-effectiveness of Solar-Powered Oxygen Delivery for Pneumonia in Young Children in Low-Resource Settings

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ABSTRACT

IMPORTANCE: Pneumonia is the leading cause of childhood mortality worldwide. Severe pneumonia associated with hypoxemia requires oxygen therapy; however, access remains unreliable in low- and middle-income countries. Solar-powered oxygen delivery (solar-powered O₂) has been shown to be a safe and effective technology for delivering medical oxygen. Examining the cost-effectiveness of this innovation is critical for guiding implementation in low-resource settings.

OBJECTIVE: To determine the cost-effectiveness of solar-powered O₂ for treating children in low-resource settings with severe pneumonia who require oxygen therapy.

DESIGN, SETTING, AND PARTICIPANTS: An economic evaluation study of solar-powered O₂ was conducted from January 12, 2020, to February 27, 2021, in compliance with the World Health Organization Choosing Interventions That Are Cost-Effective (WHO-CHOICE) guidelines. Using existing literature, plausible ranges for component costs of solar-powered O₂ were determined in order to calculate the expected total cost of implementation. The costs of implementing solar-powered O₂ at a single health facility in low- and middle-income countries was analyzed for pediatric patients younger than 5 years who required supplemental oxygen.

EXPOSURES: Treatment with solar-powered O₂.

MAIN OUTCOMES AND MEASURES: The incremental cost-effectiveness ratio (ICER) of solar-powered O₂ was calculated as the additional cost per disability-adjusted life-year (DALY) saved. Sensitivity of the ICER to uncertainties of input parameters was assessed through univariate and probabilistic sensitivity analyses. **RESULTS** The ICER of solar-powered O₂ was estimated to be \$20 (US dollars) per DALY saved (95% CI, \$2.83-\$206) relative to the null case (no oxygen). Costs of solar-powered O₂ were alternatively quantified as \$26 per patient treated and \$542 per life saved. Univariate sensitivity analysis found that the ICER was most sensitive to the volume of pediatric pneumonia admissions and the case fatality rate. The ICER was insensitive to component costs of solar-powered O₂ systems. In secondary analyses, solar-powered O₂ was cost-effective relative to grid-powered concentrators (ICER \$140 per DALY saved) and cost-saving relative to fuel generator-powered concentrators (cost saving of \$7120).

CONCLUSIONS AND RELEVANCE: The results of this economic evaluation suggest that solar-powered O₂ is a cost-effective solution for treating hypoxemia in young children in low- and middle-income countries, relative to no oxygen. Future implementation should prioritize sites with high rates of pediatric pneumonia admissions and mortality. This study provides economic support for expansion of solar-powered O₂ and further assessment of its efficacy and mortality benefit.

93. Factors associated with management of pneumonia among children by Community Health Workers in Abim district, Uganda

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ABSTRACT

INTRODUCTION: Pneumonia is a leading cause of death among children under five years of age in Uganda. Community Health Workers (CHWs) can prevent pneumonia deaths if they know how to manage the disease correctly. We conducted a study to determine factors associated with management of pneumonia among under-five year children by CHWs in Abim district, Uganda.

METHODS: This was a cross sectional study. We obtained data from 374 CHWs using a training video, questionnaire, Sick Child Job Aid (SCJA) and case vignettes. We determined the proportion of CHWs that correctly managed pneumonia. Modified Poisson regression established factors associated with management of pneumonia in children by CHWs. We conducted four key informant interviews with CHWs focal persons, and five focus group discussions with community members.

RESULTS: We found that 15.5% of CHWs correctly managed pneumonia among children as per the SCJA. In addition, 73.8% of the CHWs respiratory rate counts were close to the respiratory count of the training video with +/- five range. Educational level (Adj. PR 2.06; 95% CI: (1.18-3.61) p-value 0.011), having a CHW register (Adj. PR 0.54; 95% CI (0.30-0.98) p-value 0.041) and drug stock outs (Adj. PR 4.24; 95% CI (1.37-13.13) p-value 0.012) were significantly associated with CHW management of pneumonia. Refresher training, availability of equipment and supplies, and support supervision were the main health facility factors influencing management of pneumonia. Perceptions that CHWs could not manage pneumonia among children, drug stock outs, and lack of trust were community factors influencing CHW management of pneumonia.

CONCLUSION: A low proportion of CHWs correctly managed pneumonia among children. Strategies to improve provision of CHW registers, drugs, support supervision, refresher trainings, as well as recruiting CHWs with a minimum of secondary level of education are necessary to improve management of pneumonia among children. Communities also need to be sensitised on roles and responsibilities of CHWs in management of pneumonia.

94. It is not always Tuberculosis! A case of pulmonary cryptococcosis in an immunocompetent child in Uganda

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ABSTRACT

Pulmonary cryptococcosis is rare in immunocompetent individuals. Limited data exist regarding its occurrence in children, especially in developing countries. This case report describes an 8-year-old HIV-negative child with pulmonary cryptococcosis, previously diagnosed and treated for tuberculosis twice without improvement. Fine needle aspiration biopsy confirmed the diagnosis of pulmonary cryptococcosis and serum cryptococcal antigen test was positive. The child improved on amphotericin and fluconazole treatment. Despite the limited diagnostic capacity in many resource-constrained settings like Uganda, this case report highlights the need to investigate other causes of pneumonia in immunocompetent children that are not improving on conventional antimicrobial treatments.

Keywords: Pulmonary cryptococcosis; immunocompetent; children; Uganda.

95. Policy Challenges Facing the Scale Up of Integrated Community Case Management (iCCM) in Uganda

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ABSTRACT

BACKGROUND: Integrated Community Case Management (iCCM) of malaria, pneumonia and diarrhoea is an equity focused strategy, to increase access to care for febrile illness in children under-5 years of age, in rural communities. Lay community members are trained to diagnose and treat malaria, pneumonia and diarrhoea in children, and to identify and refer very ill children. Today, many low-income countries including Uganda, have a policy for iCCM which is being rolled out through public sector community health workers (CHWs). Ten years after the introduction of the iCCM strategy in Uganda, it is important to take stock and understand the barriers and facilitators affecting implementation of the iCCM policy.

METHODS: We conducted an iCCM policy analysis in order to identify the challenges, enablers and priorities for scale-up of the iCCM strategy in Uganda. This was a qualitative case study research which included a document review (n=52) and key informant interviews (n=15) with Ugandan stakeholders. Interviews were conducted in 2017 and the desk review included literature up to 2019.

RESULTS: This paper highlights the iCCM policy trajectory since 2010 in Uganda and includes a policy timeline. The iCCM policy process was mainly led by international agencies from inception, with little ownership of the government. Many implementation challenges including low government funding, weak coordination and contradicting policies were identified, which could contribute to the slow scale up of the iCCM program. Despite the challenges, many enablers and opportunities also exist within the health system, which should be further harnessed to scale up iCCM in Uganda. These enabling factors include strong community commitment, existing policy instruments and the potential of utilizing also the private sector for iCCM implementation.

CONCLUSION: The iCCM program in Uganda needs to be strengthened through increased domestic funding, strong coordination and a focus on monitoring, evaluation and operational research.

Keywords: Community Case management, Malaria, Pneumonia, Diarrhoea, iCCM Policy Analysis, Uganda

96. The economic burden of pneumonia in children under five in Uganda

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ABSTRACT

BACKGROUND: There were about 138 million new episodes of pneumonia and 0.9 million deaths globally in 2015. In Uganda, pneumonia was the fourth leading cause of death in children under five years of age in 2017–18. However, the economic burden of pneumonia, particularly for households and caregivers, is poorly documented.

AIM: To estimate the costs associated with an episode of pneumonia from the household, government, and societal perspectives.

METHODS: We selected 48 healthcare facilities from the public and private sector across all care levels (primary, secondary, and tertiary), based on the number of pneumonia episodes reported for 2015–16. Adult caregivers of children with pneumonia diagnosis at discharge were selected. Using an ingredient-based approach, we collected cost and utilization data from administrative databases, medical records, and patient caregiver surveys. Household costs included direct medical and non-medical costs, as well as indirect costs estimated through a human capital approach. All costs are presented in 2018 U.S. dollars.

RESULTS: The treatment of pneumonia puts a substantial economic burden on households. The average societal cost per episode of pneumonia across all sectors and types of visits was \$42; hospitalized episodes costed an average of \$62 per episode, while episodes only requiring ambulatory care was \$16 per episode. Public healthcare facilities covered \$12 and \$7 on average per hospitalized or ambulatory episode, respectively. Caregivers using the public system faced lower out-of-pocket payments, evaluated at \$17, than those who used private for-profit (\$21) and not-for-profit (\$50) for hospitalized care. For ambulatory care, out-of-pocket payments amounted to \$8, \$18, and \$9 for public, private for-profit, and not-for-profit healthcare facilities, respectively. About 39% of households experienced catastrophic health expenditures due to out-of-pocket payments related to the treatment of pneumonia.

Keywords: Pneumonia Cost-of-illness Uganda Vaccine-preventable disease Economic burden Economic benefit of immunization

97. Correlations Between Lung Pneumonic Lesions and Serologic Status to Key Respiratory Pathogens in Slaughtered Pigs in Northern Uganda

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ABSTRACT

BACKGROUND: A cross-sectional study was conducted in three selected slaughter slabs in Lira district Uganda in 2019 to (i) determine prevalence and severity of pneumonia and (ii) establish associations between lung pneumonic lesions and serologic status to key respiratory pathogens in slaughter pigs. Blood samples were collected from pigs at antemortem from which sera were prepared. Using enzyme-linked immunosorbent (ELISA) assays, sera were screened for antibodies against *Mycoplasma hyopneumoniae* (*M. hyo*), *Actinobacillus pleuropneumoniae* (*App*), porcine reproductive and respiratory syndrome virus (PRRSv) and porcine circovirus type 2 (PCV2). At post-mortem, lungs were scored for possible pneumonic lesions and the type of pneumonia as previously described. Pneumonia types were grossly characterized as catarrhal

purulent bronchopneumonia (CPBP), pleuropneumonia (PLP) and pleuritis as previously described. *Metastrongylus* spp infection was determined by examining lungs for gross presence or absence of helminths as previously described. T-tests were used to compute prevalence of pneumonia. Chi-square tests were used to compare the percentage of lungs positive or negative to CPBP, PLP and pleuritis. Ordinal logistic regression model was used to evaluate the odds of multiple pneumonia forms, with serostatus for different pathogens and *Metastrongylus* spp. infection as predictors.

RESULTS: One hundred and sixty seven (n=167) lungs were examined for pneumonic lesions. The prevalence of CPBP, PLP and pleuritis were 29.9% (95% CI 22.9-36.9), 74.2% (95% CI 67.5-80.9) and 17.3% (95% CI 22.4- 36.3), respectively. The odds of multiple pneumonia forms increased in pigs with multiple pathogens and concurrent *Metastrongylus* spp. infestation (ORs 2.6, p=0.01 and 2.5, p=0.003, respectively), reaffirming synergistic effects of coinfections in the induction of lesions.

CONCLUSIONS: This study revealed a high prevalence and severity of pneumonic lesions in slaughter pigs. It provides baseline information, undeniable evidence on the magnitude of pneumonia and justifies future studies on its potential economic impacts in Ugandan pigs.

98. Treatment of Sick Children Seeking Care in the Private Health Sector in Uganda: A Cluster Randomized Trial

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ABSTRACT.

The main objective of this study was to assess whether training of private health providers and community sensitization on the importance of effective prompt care seeking and the need for referral could improve treatment of sick children in the private health sector in Uganda. Private providers were trained to diagnose and treat sick children according to the integrated community case management (iCCM) guidelines. In the control arm, routine services were offered. The outcomes were seeking care within 24 hours of onset of symptoms and appropriate case management for malaria, pneumonia, and diarrhea among children aged < 5 years. A total of 10,809 sick children (5,955 in the intervention arm and 4,854 in the control arm) presented for diagnosis and treatment. The percentage seeking care within 24 hours of onset of symptoms was 45.4% (95% CI 36.0–48.8) in the intervention arm versus 43.9% (95% CI 38.1–49.8) in the control arm ($P = 0.04$). Adherence to malaria rapid diagnostic test (mRDT) results was high, with 1,459 (94.3%) in the intervention arm versus 1,402 (83.0%) in the control arm ($P = 0.04$). Appropriate treatment of mRDT-positive children with artemisinin-based combination therapy was seen in 93.1% (95% CI 88.5–97.7) in the intervention arm versus 85.1% (95% CI 78.6–91.7) in the control arm ($P = 0.03$). Adherence to iCCM guidelines was very high: 89.1% of children with diarrhea in the intervention arm and 80.4% in the control arm were given oral rehydration salts and zinc ($P = 0.01$). Of the children with a respiratory rate > 40 breaths/minute, 1,596 (85.1%) in the intervention arm versus 104 (54.5%) in the control arm were given amoxicillin ($P = 0.01$). In conclusion, the intervention improved treatment of malaria, pneumonia, and diarrhea because of provider adherence to treatment guidelines. The policy implications of these findings are to initiate a dialogue at district and national levels on how to scale up the intervention in the private sector. NCT02450630 registered with ClinicalTrials.gov: May 9, 2015

99. Dysregulation of angiotensin-Tie-2 axis in Ugandan children hospitalized with pneumonia

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ABSTRACT

OBJECTIVE: Pneumonia is the leading cause of death in children under 5, with the highest burden in resource-limited countries. Endothelial activation occurs in pneumonia and can be assessed using quantitative levels of biomarkers angiopoietin (Ang)-1 and Ang-2. We examined admission levels of Ang-1 and Ang-2 in pediatric pneumonia and their association with disease severity and outcome.

METHODS: Prospective cohort study of children with hypoxemic pneumonia admitted to two hospitals in Uganda. Clinical, radiographic, and microbiologic characteristics were measured at admission. Disease severity was assessed using the Respiratory Index of Severity in Children (RISC). Plasma levels of Ang-1 and Ang-2 were quantified by enzyme-linked immunosorbent assay. Vital signs, oxygen supplementation, and mortality were assessed prospectively.

RESULTS: We included 65 patients (43% female) with median age 19 months (IQR 8–24). Admission Ang-2/Ang-1 ratio directly correlated with RISC ($\rho = 0.32$, $p = 0.008$) and lactate level ($\rho = 0.48$, $p < 0.001$). Ang-2/Ang-1 ratio was higher in pneumococcal pneumonia than viral RTI (0.19 [IQR: 0.076–0.54] vs. 0.078 [IQR: 0.027–0.11]; $p = 0.03$). Elevated Ang-2/Ang-1 ratio (>0.084) was associated with prolonged tachypnea (HR 0.50 (95%CI 0.29–0.87), $p = 0.02$), fever (HR 0.56 (95%CI 0.33 to 0.96), $p = 0.02$), longer duration of oxygen therapy (HR 0.59 (95%CI 0.35–0.99), $p = 0.04$), and hospital stay (HR 0.43 (95%CI 0.25–0.74), $p = 0.001$). The Ang-2/Ang-1 ratio at admission was higher in fatal cases relative to survivors (0.36 [IQR: 0.17–0.58] vs. 0.077 [IQR: 0.025–0.19]; $p = 0.05$)

CONCLUSION: Endothelial activation in hypoxemic pediatric pneumonia, reflected by high plasma Ang-2/Ang-1 ratio, is associated with disease severity, prolonged recovery time, and mortality.

Keywords: Ang-1, Ang-2, Hypoxemic Pneumonia, Biomarker, Endothelial activation

100. Efficacy and safety of oxygen-sparing nasal reservoir cannula for treatment of pediatric hypoxemic pneumonia in Uganda: a pilot randomized clinical trial

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ABSTRACT

BACKGROUND: Oxygen is an essential therapy for hypoxemia but is scarce in low-income settings. Oxygen conserving devices optimize delivery, but to date have been designed for adults in high-income settings. Here we present the development and clinical pilot study of an oxygen-sparing nasal reservoir cannula (OSNRC) for pediatric use in low-income settings.

METHODS: (1) Pre-clinical development of a novel OSNRC using a simulated respiratory circuit with metabolic simulator and anatomically accurate face-airway models. Simulated breathing waveforms were designed based on airway resistance, lung compliance, respiratory rate, and tidal volume of spontaneous breathing for three disease conditions. (2) Pilot, randomized, controlled, non-blinded, cross-over study of the OSNRC vs standard nasal cannula (SNC) among children hospitalized with hypoxemic pneumonia in Uganda. Eight children were randomized to OSNRC followed by SNC, and eight were randomized to SNC followed by OSNRC.

RESULTS: The laboratory simulation showed that the OSNRC provided the same or higher fraction of inspired oxygen at approximately 2.5-times lower flow rate compared to SNC. The flow savings ratio exhibited a linear relationship with the OSNRC volume to tidal volume ratio with a slope that varied with breathing waveforms. The range of performance from different breathing waveforms defined a performance envelope of the OSNRC. Two mask sizes (30 mL and 50 mL) provided sufficient coverage for patients between the 3rd and 97th percentile in our targeted age range. In the clinical pilot study, the rise in capillary blood pCO₂ was similar in the OSNRC and SNC groups, suggesting that the OSNRC was not associated with CO₂ retention. There were no significant differences between OSNRC and SNC with respect to clinical adverse events, lactate levels, pH, and SpO₂. The OSNRC group had a higher mean SpO₂ than the SNC group (adjusted mean difference, 1.4, 95% confidence interval 1.1 to 1.8), showing oxygen delivery enhancement.

CONCLUSION: The OSNRC enhances oxygen delivery without causing CO₂ retention and appears to be well-tolerated by pediatric patients. If safety, efficacy and tolerability are confirmed in larger trials, this device has the potential to optimize oxygen delivery in children in low-resource settings, reducing the global burden of pediatric pneumonia. Trial registration: The trial was retrospectively registered (International Standard Registered Clinical/Social Study Number (ISRCTN): 15216845; Date of registration: 15 July 2020).

Keywords: Oxygen, Pneumonia, Africa, Child, Nasal Canula.

101. Management of Childhood Infections in Poorly Planned Urban Settlements in Kampala and Wakiso Districts of Uganda

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ABSTRACT.

The main objective of this study was to assess the management of childhood infections in high-density poorly planned urban areas of Kampala and Wakiso districts in Uganda, to develop a strategy to deliver integrated community case management (iCCM) of childhood illness services. A total of 72 private healthcare facilities were surveyed (36 drug shops, eight pharmacies, 27 private clinics, and one herbal clinic); supplemented by focus group discussions with village health teams (VHTs), drug shops, and private clinic providers. The majority of drug shops (96.4%, 27/28), pharmacies (100%, 8/8), and (68%, private clinics 17/27) were registered; however, supervision was poor. The majority of patients (> 77%) who visited private health facilities were children aged < 5 years. Furthermore, over 80% (29/64) of the children with uncomplicated malaria were reported to have been given artemether–lumefantrine, and 42% with difficulty breathing were given an antibiotic. Although > 72% providers said they referred children with severe illnesses, taking up referral was complicated by poverty, long distances, and the perception that there were inadequate drugs at referral facilities. Less than 38% of all the facilities had malaria treatment guidelines; < 15% had iCCM guidelines; 6% of the drug shops had iCCM guidelines; and < 13% of the facilities had pneumonia and diarrhea treatment guidelines. Village health teams existed in the study areas, although they had little knowledge on causes and prevention of pneumonia. In conclusion, this study found that quality of care was poor and introduction of iCCM delivered through VHTs, drug shops, and private clinics may, with proper training and support, be a feasible intervention to improve care.

102. Pneumococcal carriage and antibiotic susceptibility patterns in mother-baby pairs in a rural community in Eastern Uganda: a cross-sectional study

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ABSTRACT

BACKGROUND: Pneumonia poses a significant threat to the lives of children below five years old worldwide, contributing to a high number of hospitalizations and death. Morbidity and mortality are especially common in children under five and the elderly, although any age group can be affected. This study aimed to estimate pneumococcal carriage and determine antibiotic susceptibility patterns of the pneumococci isolated from mother-baby pairs in Ngora district after the rollout of the pneumococcal vaccine. We hypothesized that high carriage of *Streptococcus pneumoniae* in mothers leads to carriage in their babies and hence a greater chance of contracting pneumonia.

METHODS: Consecutive sampling was used to select 152 mother-baby pairs from community visits and those seeking care at the health facility. We collected nasal swabs from both baby and mother for culture and sensitivity testing using the Kirby-Bauer's agar disc diffusion method.

RESULTS: This study found that there was a low prevalence of pneumococcal carriage in the mother-baby pair in Ngora district. We also observed high rates of microbial resistance to penicillin, which is the first-line drug for the management of pneumonia in Uganda.

CONCLUSIONS: The relationship between pneumococcal carriage and immunization status suggests that the pneumococcal vaccine is protective against pneumococcal carriage. Resistance of *S. pneumoniae* to commonly used antibiotics was high.

Keywords Pneumococcal carriage, mother-baby pair, antibiotic susceptibility pattern, immunization with PCV 10, Eastern Uganda.

103. *Cor pulmonale* complicating chronic pulmonary aspergillosis with fatal consequences: Experience from Uganda

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ABSTRACT

Cor pulmonale is a rare complication of pulmonary aspergillosis (CPA). A 45-year-old Ugandan male with a history of recurrent community-acquired pneumonias was admitted with symptoms of progressive difficulty in breathing, chronic productive cough, non-exertional left sided chest pain and progressive weight loss occurring over a 12-month period. Chest CT scan and echocardiography confirmed the diagnosis of CPA with an aspergilloma complicating bronchiectasis, complicated with cor pulmonale. However, this was previously clinically misdiagnosed as PTB.

Keywords: Chronic pulmonary aspergillosis Cor pulmonale Recurrent community acquired pneumonia Itraconazole Uganda

104. HIV infection is associated with elevated biomarkers of immune activation in Ugandan adults with pneumonia

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ABSTRACT

INTRODUCTION: Pneumonia is an important cause of morbidity and mortality in persons living with human immunodeficiency virus (HIV) infection. How immune activation differs among HIV-infected and HIV-uninfected adults with pneumonia is unknown.

METHODS: The Inflammation, Aging, Microbes, and Obstructive Lung Disease (I AM OLD) Cohort is a prospective cohort of adults with pneumonia in Uganda. In this cross-sectional analysis, plasma was collected at pneumonia presentation to measure the following 12

biomarkers: interleukin 6 (IL-6), soluble tumor necrosis factor receptors 1 and 2 (sTNFR-1 and sTNFR-2), high sensitivity C-reactive protein (hsCRP), fibrinogen, D-dimer, soluble CD27 (sCD27), interferon gamma-inducible protein 10 (IP-10), soluble CD14 (sCD14), soluble CD163 (sCD163), hyaluronan, and intestinal fatty acid binding protein. We asked whether biomarker levels differed between HIV-infected and HIV-uninfected participants, and whether higher levels of these biomarkers were associated with mortality.

RESULTS: One hundred seventy-three participants were enrolled. Fifty-three percent were HIV-infected. Eight plasma biomarkers—sTNFR-1, sTNFR-2, hsCRP, D-dimer, sCD27, IP-10, sCD14, and hyaluronan—were higher among participants with HIV infection, after adjustment for pneumonia severity. Higher levels of 8 biomarkers—IL-6, sTNFR-1, sTNFR-2, hsCRP, IP-10, sCD14, sCD163, and hyaluronan—were associated with increased 2-month mortality.

CONCLUSIONS: As in other clinical contexts, HIV infection is associated with a greater degree of immune activation among Ugandan adults with pneumonia. Some of these are also associated with short-term mortality. Further study is needed to explore whether these biomarkers might predict poor long-term outcomes—such as the development of obstructive lung disease—in patients with HIV who have recovered from pneumonia.

105. Influenza-associated pneumonia hospitalizations in Uganda, 2013-2016

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ABSTRACT

BACKGROUND: Influenza is an important contributor to acute respiratory illness, including pneumonia, and results in substantial morbidity and mortality globally. Understanding the local burden of influenza-associated severe disease can inform decisions on allocation of resources toward influenza control programs. Currently, there is no national influenza vaccination program in Uganda.

METHODS: In this study, we used data on pneumonia hospitalizations that were collected and reported through the Health Management Information System (HMIS) of the Ministry of Health, Uganda, and the laboratory-confirmed influenza positivity data from severe acute respiratory

illness (SARI) surveillance in three districts (Wakiso, Mbarara, and Tororo) to estimate the age-specific incidence of influenza-associated pneumonia hospitalizations from January 2013 through December 2016.

RESULTS: The overall estimated mean annual rate of pneumonia hospitalizations in the three districts was 371 (95% confidence interval [CI] 323–434) per 100,000 persons, and was highest among children aged <5 years (1,524 [95% CI 1,286–1,849]) compared to persons aged ≥5 years (123 [95% CI 105–144]) per 100,000 persons. The estimated mean annual rate of influenza-associated pneumonia hospitalization was 34 (95% CI 23–48) per 100,000 persons (116 [95% CI 78–165] and 16 [95% CI 6–28] per 100,000 persons among children aged <5 years and those ≥5 years, respectively). Among children aged <5 years, the rate of hospitalized influenza-associated pneumonia was highest among those who were <2 years old (178 [95% CI 109–265] per 100,000 persons). Over the period of analysis, the estimated mean annual number of hospitalized influenza-associated pneumonia cases in the three districts ranged between 672 and 1,436, of which over 70% represent children aged <5 years.

CONCLUSIONS: The burden of influenza-associated pneumonia hospitalizations was substantial in Uganda, and was highest among young children aged <5 years. Influenza vaccination maybe considered, especially for the very young children.

106. Dynamics of influenza in tropical Africa: Temperature, humidity, and co-circulating (sub)types

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ABSTRACT

BACKGROUND: The association of influenza with meteorological variables in tropical climates remains controversial. Here, we investigate the impact of weather conditions on influenza in the tropics and factors that may contribute to this uncertainty.

METHODS: We computed the monthly viral positive rate for each of the 3 circulating influenza (sub)types (ie, A/H1N1, A/H3N2, and B) among patients presenting with influenza-like illness (ILI) or severe acute respiratory infections (SARI) in 2 Ugandan cities (Entebbe and Kampala). Using this measure as a proxy for influenza activity, we applied regression models to examine the impact of temperature, relative humidity, absolute humidity, and precipitation, as well as interactions among the 3 influenza viruses on the epidemic dynamics of each influenza (sub)type. A full

analysis including all 4 weather variables was done for Entebbe during 2007-2015, and a partial analysis including only temperature and precipitation was done for both cities during 2008-2014.

RESULTS: For Entebbe, the associations with weather variables differed by influenza (sub)type; with adjustment for viral interactions, the models showed that precipitation and temperature were negatively correlated with A/H1N1 activity, but not for A/H3N2 or B. A mutually negative association between A/H3N2 and B activity was identified in both Entebbe and Kampala.

CONCLUSION: Our findings suggest that key interactions exist among influenza (sub) types at the population level in the tropics and that such interactions can modify the association of influenza activity with weather variables. Studies of the relationship between influenza and weather conditions should therefore determine and account for co-circulating influenza (sub)types.

Keywords: Africa, humidity, influenza, intertypic interactions, temperature, tropical climate, Uganda

107. Knowledge and Perception of Caregivers about Risk Factors and Manifestations of Pneumonia among Under Five Children in Butaleja District, Eastern Uganda

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ABSTRACT

BACKGROUND: Despite the widespread national intervention strategies to curb its occurrence, Pneumonia remains one of the leading causes of morbidity in Butaleja district. This was a cross-sectional study carried out at Busolwe Hospital and aimed at establishing the knowledge and perception of caregivers about risk factors and manifestations of childhood pneumonia and its high prevalence among the under-five children (U5C) in the district.

METHODS: Structured researcher administered questionnaires were given to 302 caregivers of U5C visiting the hospital who were enrolled on a continuous random basis from April to May 2018. Microsoft Excel was used to retrieve and analyze the data which was then represented in form of frequencies and proportions.

RESULTS: The study found that the majority of caregivers had inadequate knowledge about the condition, despite 69.5% of their U5C having suffered from pneumonia in the previous year.

Additionally, some of the contributing factors to the high prevalence of pneumonia included poor ventilation in the houses, the presence of swamps contributing to coldness, failure to complete the immunisation dose and overcrowding in the households leading to household air pollution.

CONCLUSION: Pneumonia remains a big health challenge in Butaleja District as evidenced by the knowledge gap among caregivers as well other contributing factors which lead to its increased prevalence. In order to reduce the burden, a comprehensive community sensitisation program needs to be rolled out to address most of the factors. It would also be important to look into the possible misdiagnosis of the condition and rule out antibiotic resistance to come up with an effective management strategy for curbing the high prevalence of pneumonia among the U5C in Butaleja District. Finally, the establishment of a National Health Insurance Scheme is strongly recommended.

Keywords: Pneumonia; Butaleja District; under five children; knowledge; caregivers; immunization status; COBERS.

108. Nutritional rickets among children admitted with severe pneumonia at Mulago hospital, Uganda: a cross-sectional study

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ABSTRACT

BACKGROUND: There's abundant sunshine in the tropics but severe rickets is still observed. Nutritional rickets is associated with an increased risk of acute lower respiratory infections. Pneumonia is the leading cause of death in the under 5 -year old children with the highest burden in developing countries. Both Pneumonia and rickets are common in the developing countries and may affect clinical presentation and outcome. This study aimed to determine the prevalence and associated factors of nutritional rickets in children admitted with severe pneumonia.

METHODS: This was a cross-sectional study of children aged 2–59 months presenting with severe pneumonia at an emergency unit. We enrolled 221 children between February and June 2012 after consent. A pre-coded questionnaire was used to collect data on socio-demographic, nutritional and past medical history. Physical exam was done for signs of rickets and anthropometric measurements. Serum calcium, phosphorus, and alkaline phosphatase (ALP) were assessed. Children with any physical signs of rickets or biochemical rickets (ALP > 400 IU); had a wrist x-ray done. Nutritional rickets was defined as the presence of radiological changes of cupping or fraying and/ or metaphyseal thickening. Severe pneumonia was defined using the

WHO criteria. Statistical analysis was performed using the Stata 10 statistical package. P- value < 0.05 was significant.

RESULTS: The prevalence of nutritional rickets among children with severe pneumonia is 9.5%. However, 14.5% had raised ALP (biochemical rickets). The factors independently associated with rickets was an elevated alkaline phosphatase; p-value < 0.001, or 32.95 95% CI (10.54–102.93). Other factors like breastfeeding, big family size, birth order were not significantly associated with rickets. Low serum calcium was detected in 22 (9.9%) of the 221 participants. Overall few children with rickets had typical clinical features of rickets on physical examination.

CONCLUSION: Rickets is a common problem in our setting despite ample sunshine. Clinicians should actively assess children for rickets in this setting and screen for rickets in those children at high risk even without clinical features.

Keywords: Rickets, Pneumonia, Children, Uganda

109. Precision Surveillance for Viral Respiratory Pathogens: Virome Capture Sequencing for the Detection and Genomic Characterization of Severe Acute Respiratory Infection in Uganda

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ABSTRACT

BACKGROUND: Precision public health is a novel set of methods to target disease prevention and mitigation interventions to high-risk subpopulations. We applied a precision public health strategy to syndromic surveillance for severe acute respiratory infection (SARI) in Uganda by combining spatiotemporal analytics with genomic sequencing to detect and characterize viral respiratory pathogens with epidemic potential.

METHODS: Using a national surveillance network we identified patients with unexplained, influenza-negative SARI from 2010 to 2015. Spatiotemporal analyses were performed retrospectively to identify clusters of unexplained SARI. Within clusters, respiratory viruses were detected and characterized in naso- and oropharyngeal swab samples using a novel oligonucleotide probe capture (VirCapSeq-VERT) and high-throughput sequencing platform. Linkage to conventional epidemiologic strategies further characterized transmission dynamics of identified pathogens.

RESULTS: Among 2901 unexplained SARI cases, 9 clusters were detected, accounting for 301 (10.4%) cases. Clusters were more likely to occur in urban areas and during biannual rainy seasons. Within detected clusters, we identified an unrecognized outbreak of measles-associated SARI; sequence analysis implicated circulation of endemic genotype B3 and genotype D4 likely imported from England. We also detected a likely nosocomial SARI cluster associated with a novel picobirnavirus most closely related to swine and dromedary viruses.

CONCLUSIONS: Using a precision approach to public health surveillance, we detected and characterized the genomics of vaccine-preventable and zoonotic respiratory viruses associated with clusters of severe respiratory infections in Uganda. Future studies are needed to assess the feasibility, scalability, and impact of applying similar approaches during real-time public health surveillance in low-income settings.

Keywords: acute respiratory infection; surveillance; sequencing; Africa South of the Sahara.

110. Quality of care in integrated community case management services in Bugoye, Uganda: a retrospective observational study

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ABSTRACT

BACKGROUND: Village health workers (VHWs) in five villages in Bugoye sub county (Kasese District, Uganda) provide integrated community case management (iCCM) services, in which VHWs evaluate and treat malaria, pneumonia, and diarrhoea in children under 5 years of age. VHWs use a “Sick Child Job Aid” that guides them through the evaluation and treatment of these illnesses. A retrospective observational study was conducted to measure the quality of iCCM care provided by 23 VHWs in 5 villages in Bugoye sub county over a 2-year period.

METHODS: Patient characteristics and clinical services were summarized using existing aggregate programme data. Lot quality assurance sampling of individual patient records was used to estimate adherence to the iCCM algorithm, VHW-level quality (based on adherence to the iCCM protocol), and change over time in quality of care (using generalized estimating equations regression modelling).

RESULTS: For each of 23 VHWs, 25 patient visits were randomly selected from a 2-year period after iCCM care initiation. In these visits, 97% (150) of patients with diarrhoea were treated with oral rehydration and zinc, 95% (216) of patients with pneumonia were treated with amoxicillin, and 94% (240) of patients with malaria were treated with artemisinin-based combination therapy or rectal artesunate. However, only 44% (44) of patients with a negative rapid test for malaria were appropriately referred to a health facility. Overall, 75% (434) of patients received all the correct evaluation and management steps. Only 9 (39%) of the 23 VHWs met the pre-determined LQAS threshold for high-quality care over the 2-year observation period. Quality of care increased significantly in the first 6 months after initiation of iCCM services ($p = 0.003$), and then plateaued during months 7–24.

CONCLUSIONS: Quality of care was high for uncomplicated malaria, pneumonia and diarrhoea. Overall quality of care was lower, in part because VHWs often did not follow the guidelines to refer patients with fever who tested negative for malaria. Quality of care appears to improve in the initial months after iCCM implementation, as VHWs gain initial experience in iCCM care.

Keywords: Village health workers, Community health workers, integrated community case management, Quality of care

111. The use of low-cost Android tablets to train community health workers in Mukono, Uganda, in the recognition, treatment and prevention of pneumonia in children under five: a pilot randomised controlled trial

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ABSTRACT

BACKGROUND: Since 2012, The World Health Organization and UNICEF have advocated for community health workers (CHWs) to be trained in Integrated Community Case Management (iCCM) of common childhood illnesses, such as pneumonia. Despite the effectiveness of iCCM, CHWs face many barriers to accessing training. This pilot study compares traditional training with using locally made videos loaded onto low-cost Android tablets to train CHWs on the pneumonia component of iCCM.

METHODS: We conducted a pilot randomised controlled trial with CHWs in the Mukono District of Uganda. The unit of randomisation was the sub-county level, and the unit of analysis was at the level of the individual CHW. Eligible CHWs had completed basic iCCM training but had not received any refresher training on the pneumonia component of iCCM in the preceding 2 years. CHWs in the control group received training in the recognition, treatment, and prevention of pneumonia as it is currently delivered, through a 1-day, in-person workshop. CHWs allocated to the intervention group received training via locally made educational videos hosted on low-cost Android tablets. The primary outcome was change in knowledge acquisition, assessed through a multiple choice questionnaire before and after training, and a post-training clinical assessment. The secondary outcome was a qualitative evaluation of CHW experiences of using the tablet platform.

RESULTS: In the study, 129 CHWs were enrolled, 66 and 63 in the control and intervention groups respectively. CHWs in both groups demonstrated an improvement in multiple choice question test scores before and after training; however, there was no statistically significant difference in the improvement between groups ($t = 1.15$, $p = 0.254$). There was a statistically significant positive correlation (Pearson's $r = 0.26$, $p = 0.03$) linking years of education to improvement in test scores in the control group, which was not present in the intervention group. The majority of CHWs expressed satisfaction with the use of tablets as a training tool; however, some reported technical issues ($n = 9$).

CONCLUSION: Tablet-based training is comparable to traditional training in terms of knowledge acquisition. It also proved to be feasible and a satisfactory means of delivering training to CHWs. Further research is required to understand the impacts of scaling such an intervention.

Keywords: Community health worker (CHW), Uganda, Pneumonia, mHealth, Mobile technologies, Integrated Community Case Management (iCCM)

112. Variation in the quality and out-of-pocket cost of treatment for childhood malaria, diarrhoea, and pneumonia: Community and facility based care in rural Uganda

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ABSTRACT

BACKGROUND: A key barrier to appropriate treatment for malaria, diarrhoea, and pneumonia (MDP) in children under 5 years of age in low income rural settings is the lack of access to quality health care. The WHO and UNICEF have therefore called for the scale-up of integrated community case management (iCCM) using community health workers (CHWs). The current study assessed access to treatment, out-of-pocket expenditure and the quality of treatment provided in the public and private sectors compared to national guidelines, using data collected in a large representative survey of caregivers of children in 205 villages with iCCM-trained CHWs in mid-Western Uganda.

RESULTS: The prevalence of suspected malaria, diarrhoea and suspected pneumonia in the preceding two weeks in 6501 children in the study sample were 45%, 11% and 24% respectively. Twenty percent of children were first taken to a CHW, 56% to a health facility, 14% to other providers and no care was sought for 11%. The CHW was more likely to provide appropriate treatment compared to any other provider or to those not seeking care for children with MDP (RR 1.51, 95% CI 1.42–1.61, $p < 0.001$). Seeking care from a CHW had the lowest cost out-lay (median \$0.00, IQR \$0.00-\$1.80), whilst seeking care to a private doctor or clinic the highest (median \$2.80, IQR \$1.20-\$6.00). We modelled the expected increase in overall treatment coverage if children currently treated in the private sector or not seeking care were taken to the CHW instead. In this scenario, coverage of appropriate treatment for MDP could increase in total from the current rate of 47% up to 64%.

CONCLUSION: scale-up of iCCM-trained CHW programmes is key to the provision of affordable, high quality treatment for sick children, and can thus significantly contribute to closing the gap in coverage of appropriate treatment.

113. Childhood pneumonia diagnostics: community health workers' and national stakeholders' differing perspectives of new and existing aids

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ABSTRACT

BACKGROUND: Pneumonia heavily contributes to global under-five mortality. Many countries use community case management to detect and treat childhood pneumonia. Community health workers (CHWs) have limited tools to help them assess signs of pneumonia. New respiratory rate (RR) counting devices and pulse oximeters are being considered for this purpose.

OBJECTIVE: To explore perspectives of CHWs and national stakeholders regarding the potential usability and scalability of seven devices to aid community assessment of pneumonia signs.

DESIGN: Pile sorting was conducted to rate the usability and scalability of 7 different RR counting aids and pulse oximeters amongst 16 groups of participants. Following each pile-sorting session, a focus group discussion (FGD) explored participants' sorting rationale. Purposive sampling was used to select CHWs and national stakeholders with experience in childhood pneumonia and integrated community case management (iCCM) in Cambodia, Ethiopia, Uganda and South Sudan. Pile-sorting data were aggregated for countries and participant groups. FGDs were audio recorded and transcribed verbatim. Translated FGDs transcripts were coded in NVivo 10 and analysed using thematic content analysis. Comparative analysis was performed between countries and groups to identify thematic patterns.

RESULTS: CHWs and national stakeholders across the four countries perceived the acute respiratory infection (ARI) timer and fingertip pulse oximeter as highly scalable and easy for CHWs to use. National stakeholders were less receptive to new technologies. CHWs placed greater priority on device acceptability to caregivers and children. Both groups felt that heavy reliance on electricity reduced potential scalability and usability in rural areas. Device simplicity, affordability and sustainability were universally valued.

CONCLUSIONS: CHWs and national stakeholders prioritise different device characteristics according to their specific focus of work. The views of all relevant stakeholders, including health workers, policy makers, children and parents, should be considered in future policy decisions, research and development regarding suitable pneumonia diagnostic aids for community use.

Keywords Childhood pneumonia; low-income country; diagnostic tools; pulse oximeter; respiratory rate counting.

114. Comparison of the capacity between public and private health facilities to manage under-five children with febrile illnesses in Uganda

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ABSTRACT

BACKGROUND: Public health facilities are usually the first to receive interventions compared to private facilities, yet majority of health seeking care is first done with the latter. This study compared the capacity to manage acute febrile illnesses in children below 5 years in private vs public health facilities in order to design interventions to improve quality of care.

METHODS: A survey was conducted within 57 geographical areas (parishes), from August to October 2014 in Mukono district, central Uganda. The survey comprised both facility and health worker assessment. Data were collected on drug stocks, availability of treatment guidelines, diagnostic equipment, and knowledge in management of malaria, pneumonia and diarrhoea, using a structured questionnaire.

RESULTS: A total of 53 public and 241 private health facilities participated in the study. While similar proportions of private and public health facilities stocked Coartem, the first-line anti-malarial drug, (98 vs 95%, $p = 0.22$), significantly more private than public health facilities stocked quinine (85 vs 53%, $p < 0.01$). Stocks of obsolete anti-malarial drugs, such as chloroquine, were reported in few public and private facilities (3.7 vs 12.5%, $p = 0.06$). Stocks of antibiotics amoxicillin and gentamycin were similar in both sectors ($\geq 90\%$ for amoxicillin; ≥ 50 for gentamycin). Training in malaria was reported by 65% of public health facilities vs 56% in the private sector, $p = 0.25$, while, only 21% in the public facility and 12% in the private facilities, $p = 0.11$, reported receiving training in pneumonia. Only 55% of public facilities had microscopes. Malaria treatment guidelines were significantly lacking in the private sector, $p = 0.01$. Knowledge about first-line management of uncomplicated malaria, pneumonia and diarrhoea was significantly better in the public facilities compared to the private ones, though still sub-optimal.

CONCLUSION: Deficiencies of equipment, supplies and training exist even in public health facilities. In order to significantly improve the capacity to handle acute febrile illness among children under five, training in proper case management, availability of supplies and diagnostics need to be addressed in both sectors.

Keywords: Malaria, Pneumonia, Diarrhoea, Comparison, Private sector, Public health facilities, Management of febrile children, Under-five children, Uganda.

115. Evaluating the impact of two training interventions to improve diagnosis and case-management of malaria and pneumonia in Uganda

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ABSTRACT

We present an age-structured mathematical model of malaria and pneumonia to study the effect of two capacity-building interventions: Integrated Management of Infectious Diseases (IMID) and On-site Support Services (OSS). IMID leads to a reduction in malaria prevalence by more than 2·4% across the [0,5), [5,14) and [14,50) age groups. IMID + OSS reduces it by more than 16·0% across all age groups. IMID decreases pneumonia prevalence by more than 3·0% across all age groups while IMID + OSS decreases it by more than 1·0% across all age groups. The number of malaria and pneumonia deaths is reduced by 7·8% by IMID across all age groups and IMID + OSS decreases this number by 30·5% across all age groups, which translates to saving a life of a child per month. Prevalence of malaria-pneumonia for the [0,5) age group is 0·52% at baseline, and IMID and IMID + OSS reduce it by 6·6% and 23·6%, respectively. There is no change in incidence of malaria or pneumonia disease episodes. The results also indicate that triaging of children contributes more than 50% to the effect of the interventions in reduction of deaths and a range of 14–91% in reduction of disease cases.

Key words: Intervention, malaria, mathematical model, pneumonia, training.

116. Integrated community case management in a peri-urban setting: a qualitative evaluation in Wakiso District, Uganda

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ABSTRACT

BACKGROUND: Integrated community case management (iCCM) strategies aim to reach poor communities by providing timely access to treatment for malaria, pneumonia and diarrhoea for children under 5 years of age. Community health workers, known as Village Health Teams (VHTs) in Uganda, have been shown to be effective in hard-to-reach, underserved areas, but there is little evidence to support iCCM as an appropriate strategy in non-rural contexts. This study aimed to inform future iCCM implementation by exploring caregiver and VHT member perceptions of the value and effectiveness of iCCM in peri-urban settings in Uganda.

METHODS: A qualitative evaluation was conducted in seven villages in Wakiso district, a rapidly urbanising area in central Uganda. Villages were purposively selected, spanning a range of peri-urban settlements experiencing rapid population change. In each village, rapid appraisal activities were undertaken separately with purposively selected caregivers (n = 85) and all iCCM-trained VHT members (n = 14), providing platforms for group discussions. Fifteen key informant interviews were also conducted with community leaders and VHT members. Thematic analysis was based on the 'Health Access Livelihoods Framework'.

RESULTS: iCCM was perceived to facilitate timely treatment access and improve child health in peri-urban settings, often supplanting private clinics and traditional healers as first point of care. Relative to other health service providers, caregivers valued VHTs' free, proximal services, caring attitudes, perceived treatment quality, perceived competency and protocol use, and follow-up and referral services. VHT effectiveness was perceived to be restricted by inadequate diagnostics, limited newborn care, drug stockouts and VHT member absence – factors which drove utilisation of alternative providers. Low community engagement in VHT selection, lack of referral transport and poor availability of referral services also diminished perceived effectiveness. The iCCM strategy was widely perceived to result in economic savings and other livelihood benefits.

CONCLUSIONS: In peri-urban areas, iCCM was perceived as an effective, well-utilised strategy, reflecting both VHT attributes and gaps in existing health services. Depending on health system resources and organisation, iCCM may be a useful transitional service delivery approach.

Implementation in peri-urban areas should consider tailored community engagement strategies, adapted selection criteria, and assessment of population density to ensure sufficient coverage.

Keywords: Child health, Integrated community case management (iCCM), Peri-urban health care, Health care access, Community health worker, Malaria, Pneumonia, Diarrhoea, COMDIS-HSD, Uganda.

117. Spatial and temporal distribution of contagious bovine pleuro-pneumonia in Uganda (1956-2011)

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ABSTRACT

INTRODUCTION: contagious bovine pleuro-pneumonia (CBPP) is a notifiable trans-boundary bovine disease, which is endemic in a large area of Sub-Saharan Africa, including Uganda. Recently, the disease has emerged from new areas, with high impacts, hence threatening the food security and livelihoods of different animal owners. This study described the temporal and spatial distribution of CBPP in Uganda, and factors associated with its occurrence.

METHODS: data previously archived at the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) in Uganda, from 1956 to 2011, were analyzed using Microsoft Excel and SPSS software.

RESULTS: the temporal distribution of CBPP during the study period showed three phases; the first phase (1956-1974), the second phase (1975-1990), and the third phase (1990 to 2011). Between 1956 and 1974, CBPP in Uganda was mainly reported from Karamoja, Northern and Central regions. Between 1975 and 1990, due to possible breakdown in surveillance systems in Uganda, there was extensive illegal cattle movement in the country, leading to CBPP spread from Karamoja region where it was endemic, to other regions of Uganda. Between 1991 and 2011, CBPP was reported all over the country, with the majority of cases (89.9%) reported from Karamoja region. Most CBPP cases were reported during the dry month of November (39.5%).

CONCLUSION: CBPP occurrence in Uganda during this study period varied significantly over study periods. More new cases were being reported in new regions of the country since the disease was first reported, possibly due to mainly political instability and uncontrolled livestock movement.

118. Trend and outcome of notified children with tuberculosis during 2011-2015 in Kampala, Uganda

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ABSTRACT

BACKGROUND: The road map for childhood tuberculosis launched in 2013 provided strong renewed efforts focused towards zero deaths due to tuberculosis in children. From 2010, there were efforts to improve childhood tuberculosis diagnosis in Kampala and this study aimed to document the trend and outcome of tuberculosis in children over the period.

METHODS: This was a retrospective study of tuberculosis data for Kampala city for the period 2011–2015. We extracted data from the unit TB registers in the 52 Diagnostic and treatment units (DTUs) in the Kampala. We report on data for children 0 to 14 years.

RESULTS: We accessed 33,221 TB patient records of which 2333 (7.0% 95% CI 6.7 to 7.3) were children. The proportion of children with pulmonary TB was 80% (1870/2333) (95% CI 76.7 to 83.7 and extra-pulmonary TB accounted for 20% (463/2333) (CI 18.3 to 21.5). Among pulmonary TB cases, the clinically diagnosed were 82% (1530/1870) (95% CI 80.0 to 83.5) while the bacteriologically confirmed were 18% (340/1870) (95% CI 16.5 to 20.0). Among the bacteriologically confirmed, 45% (154/340) (95% CI 40.1 to 50.6) were smear positive. During the study period 2011 through 2015, the childhood TB notification rate declined as follows; 105, 76, 72, 88, and 74 per 100,000 respectively. The treatment success rate increased from 78% in 2011 to 83% in 2015.

CONCLUSIONS: The TB notification rate among children in Kampala city showed a large decline during the period 2011 to 2015. There was a slight improvement in the treatment success rate among the children.

119. Where there is no doctor: can volunteer community health workers in rural Uganda provide integrated community case management?

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ABSTRACT

INTRODUCTION: Integrated community case management (iCCM) involves assessment and treatment of common childhood illnesses by community health workers (CHWs). Evaluation of a new Ugandan iCCM program is needed.

OBJECTIVES: The objectives of this study were to assess if iCCM by lay volunteer CHWs is feasible and if iCCM would increase proportions of children treated for fever, pneumonia, and diarrhoea in rural Uganda.

METHODS: This pre/post study used a quasi-experimental design and non-intervention comparison community. CHWs were selected, trained, and equipped to assess and treat children under five years with signs of the three illnesses. Evaluation included CHW-patient encounter record review plus analysis of pre/post household surveys.

RESULTS: 196 iCCM-trained CHWs reported 6,276 sick child assessments (45% fever, 46% pneumonia, 9% diarrhoea). 93% of cases were managed according to algorithm recommendations. Absolute proportions of children receiving treatment significantly increased post-intervention: antimalarial for fever (+24% intervention versus +4% control) and oral rehydration salts/zinc for diarrhoea (+14% intervention versus +1% control).

CONCLUSION: In our limited-resource, rural Ugandan setting, iCCM involving lay CHWs was feasible and significantly increased the proportion of young children treated for malaria and diarrhoea.

Keywords: Uganda; maternal health; child health; community health worker; integrated community case management.

120. Antibiotic use in acute respiratory infections in under-fives in Uganda: findings and implications

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ABSTRACT

OBJECTIVES: Self-medication with antibiotics among households is common in Uganda. However, there are limited studies evaluating self-purchasing of antibiotics for acute respiratory infections (ARI) in the under-fives. Consequently, the objective was to evaluate patterns of household self-medication with antibiotics in ARI among under-fives in Kampala.

METHODS: Descriptive cross-sectional observational design. Caretakers at households were selected from five divisions of Kampala using the WHO 30-cluster method and interviewed using a standardized questionnaire in June - July 2011.

RESULTS: Out of the 200 households, most ARI cases 107 (53.5%; $p = 0.322$) were inappropriately managed. The prevalence of antibiotic use in ARI was 43% ($p < 0.001$). Amoxicillin 31.4% and cotrimoxazole (30%) were the most self-medicated antibiotics. Antibiotics use was associated with pneumonia symptoms and access to antibiotics.

CONCLUSIONS: Household use of antibiotics in ARIs among under-fives is suboptimal. There is an urgent need for guidelines on awareness to reduce self-medication of ARIs in Uganda.

Key words: Acute respiratory infections (ARI), antibiotics, under-fives, households, self-medication, Uganda.

121. Epidemiologic and Spatiotemporal Characterization of Influenza and Severe Acute Respiratory Infection in Uganda, 2010-2015

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ABSTRACT

RATIONALE: Little is known about the epidemiology of severe acute respiratory infection (SARI) or influenza in sub-Saharan Africa. Characterization of influenza transmission dynamics and risk factors for severe disease and mortality is critical to inform prevention and mitigation strategies.

OBJECTIVES: To characterize the epidemiology and transmission dynamics of influenza and risk factors for influenza-associated severe respiratory infection in Uganda.

METHODS: Clinicians at 12 sentinel surveillance sites prospectively collected clinical data and upper respiratory tract samples from consecutive patients who met criteria for SARI and influenza-like illness (ILI). Samples were tested for influenza A and B viruses using real-time reverse transcription–polymerase chain reaction. Spatial and spatiotemporal cluster modeling was performed to identify loci of increased influenza transmission. Morbidity and mortality were assessed through chart review in a defined subset of patients. Univariable and multivariable analyses were used to identify risk factors for severe respiratory infection, prolonged hospitalization, and in-hospital mortality.

MEASUREMENTS AND MAIN RESULTS: From October 2010 to June 2015, 9,978 patients met case definitions for SARI and ILI and had samples tested for influenza A and B. Of the 9,978 patient samples tested, 1,113 (11.2%) were positive for influenza. Among 6,057 patients with ILI, 778 samples (12.8%) were positive, and among 3,921 patients with SARI, 335 samples (8.5%) were positive. Significant clustering of influenza cases was observed in urban and peri-urban areas and during rainy seasons. Among 1,405 cases of SARI with available outcome data, in-hospital mortality was 1.6%. Infection with the 2009 pandemic A/H1N1 subtype and prolonged time to presentation were independently associated with SARI among influenza cases.

CONCLUSIONS: Influenza is associated with a substantial proportion of acute respiratory infection in Uganda. As influenza vaccination programs are developed in East Africa, timing campaigns to confer protection during rainy seasons should be considered, particularly among high-risk urban populations.

Keywords: Africa South of the Sahara; acute respiratory infection; influenza; epidemiology; spatiotemporal analysis

122. Frequency and distribution patterns of opportunistic infections associated with HIV/AIDS in Uganda

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ABSTRACT

BACKGROUND: We conducted a study to assess the frequency and distribution patterns of selected opportunistic infections (OIs) and opportunistic cancers (OCs) in different geographical areas before and after HAART in Uganda.

METHODS: This was a cross-sectional serial review of observation data for adult HIV positive patients (≥ 15 years) enrolled with the AIDS support organization (TASO) in Uganda covering the period from January 2001 to December 2013. Both AIDS defining OIs/OCs and non-AIDS defining OIs were analyzed. The study period was structured into three time periods: “pre-HAART” (2001–2003), “early-HAART” (2004–2008) and “late-HAART” (2009–2013). Descriptive statistics were used to summarize the data by time period, age, gender and geographical location. Chi squared test used to test the significance of the differences in proportions.

RESULTS: A total of 108,619 HIV positive patients were included in the analysis. 64% (64,240) were female with median age of 33 years (IQR 27–40). The most frequent OIs before HAART were oral candida (34.6%) diarrhoeal infection (< 0.05) before and after HAART for geohelminths, candidiasis, diarrhoeal infection, bacterial pneumonia and genital ulcer disease but consistently higher in men for TB and Kaposi’s sarcoma ($p < 0.05$). By age, prevalence was consistently higher in older age groups (> 30 years) before and after HAART for oral candida and TB ($p < 0.05$) and higher in young age groups (< 0.05). By geographical location, prevalence was consistently higher in Eastern and Northern Uganda before and after HAART for diarrheal infection and geohelminths ($p < 0.0001$).

CONCLUSIONS: The frequency and pattern of OIs before and after HAART differs by gender, age and geographical location. Prevalence of geohelminths and diarrhea infection (< 1 month) remains high especially in Northern and Eastern Uganda even after HAART and should therefore be given special attention in HIV/AIDS care programmes in these settings.

Keywords: HIV/AIDS, Opportunistic infections, Antiretroviral therapy, Prevalence, TASO, Uganda

123. Pneumococcal Carriage in Children under Five Years in Uganda—Will Present Pneumococcal Conjugate Vaccines Be Appropriate?

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ABSTRACT

BACKGROUND: Pneumonia is the major cause of death in children globally, with more than 900,000 deaths annually in children under five years of age. *Streptococcus pneumoniae* causes most deaths, most often in the form of community acquired pneumonia. Pneumococcal conjugate vaccines (PCVs) are currently being implemented in many low-income countries. PCVs decrease vaccine-type pneumococcal carriage, a prerequisite for invasive pneumococcal disease, and thereby affects pneumococcal disease and transmission. In Uganda, PCV was launched in 2014, but baseline data is lacking for pneumococcal serotypes in carriage. Objectives To study pneumococcal nasopharyngeal carriage and serotype distribution in children under 5 years of age prior to PCV introduction in Uganda

METHODS: Three cross-sectional pneumococcal carriage surveys were conducted in 2008, 2009 and 2011, comprising respectively 150, 587 and 1024 randomly selected children aged less than five years from the Iganga/Mayuge Health and Demographic Surveillance Site. The caretakers were interviewed about illness history of the child and 1723 nasopharyngeal specimens were collected. From these, 927 isolates of *S. pneumoniae* were serotyped.

RESULTS: Overall, the carriage rate of *S. pneumoniae* was 56% (957/1723). Pneumococcal carriage was associated with illness on the day of the interview (OR = 1.50, $p = 0.04$). The most common pneumococcal serotypes were in descending order 19F (16%), 23F (9%), 6A (8%), 29 (7%) and 6B (7%). One percent of the strains were non-typeable. The potential serotype coverage rate for PCV10 was 42% and 54% for PCV13.

Conclusion About half of circulating pneumococcal serotypes in carriage in the Ugandan under-five population studied was covered by available PCVs.

124. A Clinical Predictor Score for 30-Day Mortality among HIV-Infected Adults Hospitalized with Pneumonia in Uganda

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ABSTRACT

BACKGROUND: Pneumonia is a major cause of mortality among HIV-infected patients. Pneumonia severity scores are promising tools to assist clinicians in predicting patients' 30-day mortality, but existing scores were developed in populations infected with neither HIV nor tuberculosis (TB) and include laboratory data that may not be available in resource-limited settings. The objective of this study was to develop a score to predict mortality in HIV-infected adults with pneumonia in TB-endemic, resource-limited settings.

METHODS: We conducted a secondary analysis of data from a prospective study enrolling HIV-infected adults with cough ≥ 2 weeks and < 6 months and clinically suspected pneumonia admitted to Mulago Hospital in Kampala, Uganda from September 2008 to March 2011. Patients provided two sputum specimens for mycobacteria, and those with *Ziehl-Neelsen* sputum smears that were negative for mycobacteria underwent bronchoscopy with inspection for Kaposi sarcoma and testing for mycobacteria and fungi, including *Pneumocystis jirovecii*. A multivariable best subsets regression model was developed, and one point was assigned to each variable in the model to develop a clinical predictor score for 30-day mortality.

RESULTS: Overall, 835 patients were studied (mean age 34 years, 53.4% female, 30-day mortality 18.2%). A four-point clinical predictor score was identified and included heart rate > 120 beats/minute, respiratory rate > 30 breaths/minute, oxygen saturation $< 90\%$, and CD4 cell count < 50 cells/mm³. Patients' 30-day mortality, stratified by score, was: score 0 or 1, 12.6%, score 2 or 3, 23.4%, score 4, 53.9%. For each 1 point change in clinical predictor score, the odds of 30-day mortality increased by 65% (OR 1.65, 95% CI 1.39-1.96, $p < 0.001$).

CONCLUSIONS: A simple, four-point scoring system can stratify patients by levels of risk for mortality. Rapid identification of higher risk patients combined with provision of timely and appropriate treatment may improve clinical outcomes. This predictor score should be validated in other resource-limited settings.

125. A protocol for engaging unlicensed private drug shops in Rural Eastern Uganda for Integrated Community Case Management (ICCM) of malaria, pneumonia and diarrhoea in children under 5 years of age

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ABSTRACT

INTRODUCTION: Malaria, pneumonia and diarrhoea are leading causes of death in young children in Uganda. In 2010, Integrated Community Case Management (ICCM) was adopted in Uganda for community level diagnosis and treatment of these diseases through community health workers. However, 50–60% of sick children will receive treatment from the private sector, especially drug shops. Only about half of drug shops are licensed and the quality of care is poor. There is an urgent need to improve quality of care and regulation of drug shops in Uganda.

METHODS: This is a pre–post cross-sectional study with before and after measurement in an intervention area in Kamuli district. A snowball mapping exercise, exit interviews, focus group discussions and interviews will be used. 25 randomly selected drug shops will be selected for an intervention that will assist drug shops to become licensed, and provide five days of ICCM training, subsidised pre-packaged medicines (artemisinin-based combination therapies for malaria, amoxicillin for pneumonia, Oral Rehydration Salts/zinc for diarrhoea) and free diagnostic tools (rapid diagnostic tests, respiratory timers, thermometers, algorithms). We anticipate a sample size of 1200 (600 at baseline and 600 at the end of the study).

ANALYSIS: Quantitative data will be analysed using SPSS for proportions and CIs. Bivariate and multiple logistic regression analysis with adjustment for clustering of data will be performed to adjust for confounding and determine intervention effect. Qualitative data will be entered into NVivo 10 and analysed using content analysis.

ETHICS AND DISSEMINATION: Research ethics approval is received from the University of Calgary (REB 14–0269), and Makerere University (IRB00011353). Findings from this study will be disseminated through journal articles and conference presentations, and will illustrate the feasibility of introducing ICCM for drug shops

126. Acceptability and Utilization of Community Health Workers after the Adoption of the Integrated Community Case Management Policy in Kabarole District in Uganda

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ABSTRACT

BACKGROUND: Malaria, pneumonia and diarrhea remains to be the major causes of morbidity and mortality among children in Uganda. To address such challenges, the government adopted a national policy on Integrated Community Case Management (ICCM) for malaria, pneumonia and diarrhea in 2010. The aim of this study was to assess household access, utilization and acceptability of ICCM services in Kabarole District.

METHODS: The study was carried out between 22nd November to 4th December, 2014 in Rwimi sub-county, Kabarole district. A cross sectional household survey was conducted amongst caretakers of children below 5 years of age and a total of 384 respondents were interviewed about distance from nearest health facility and community health worker, socio-demographic characteristics, type of housing, history of fever, health-seeking behavior, perceptions of quality and utilization of ICCM services. Data was cleaned, coded and analysed using STATA 14.0 to produce results.

RESULTS: Most 53.1% of the studied children were males and their age ranged from 1–52 months. Nearly all the care takers, 97.1% (373/384) had utilized health services for their children in the three proceeding months to the study and of those, 0.5% (2/373) sought from a traditional healer, 8.6% (32/373) sought treatment at home, 27.3% (102/373) from community health worker, 27.3% (102/373) from government health unit and 36.2% (133/373) from non-government health units. The caretakers who stay near CHWs are more likely to utilize ICCM services than those staying near health facilities ($P=0.001$). The majority 65.6% of the caretakers stay near CHWs and use only 10 minutes to reach the CHWs. Trust in CHWs [AOR 0.85, 95%CI [0.641–1.135]], level of awareness [AOR 0.73, 95%CI [0.538–0.979]] and distance (≤ 1 km) to CHWs [AOR 1.65, 95%CI [1.075–2.522]] are positively associated with the utilisation of ICCM services.

CONCLUSION: The implementation of ICCM policy in kabarole has been an effective approach in increasing the utilization of malaria, diarrhea and pneumonia treatment services and hence increasing access to health services at community level. Trust in the CHWs, level of community awareness and distance to the CHWs are positively associated with the utilisation of ICCM services.

Keywords: Community health worker; Village health teams; Integrated community case management

127. Drug seller adherence to clinical protocols with integrated management of malaria, pneumonia and diarrhoea at drug shops in Uganda

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ABSTRACT

BACKGROUND: Drug shops are usually the first source of care for febrile children in Uganda although the quality of care they provide is known to be poor. Within a larger quasi-experimental study introducing the WHO/UNICEF recommended integrated community case management (iCCM) of malaria, pneumonia and diarrhoea intervention for community health workers in registered drug shops, the level of adherence to clinical protocols by drug sellers was determined.

METHODS: All drug shops (N = 44) in the intervention area were included and all child visits (N = 7,667) from October 2011–June 2012 to the participating drug shops were analysed. Drug shops maintained a standard iCCM register where they recorded the children seen, their symptoms, diagnostic test performed, treatments given and actions taken. The proportion of children correctly assessed and treated was determined from the registers.

RESULTS: Malaria management: 6,140 of 7,667 (80.1%) total visits to drug shops were of children with fever. 5986 (97.5%) children with fever received a malaria rapid diagnostic test (RDT) and the RDT positivity rate was 78% (95% CI 77–79). 4,961/5,307 (93.4%) children with a positive RDT received artemisinin combination therapy. Pneumonia management: after respiratory rate assessment of children with cough and fast/difficult breathing, 3,437 (44.8%) were categorized as “pneumonia”, 3,126 (91.0%) of whom received the recommended drug—amoxicillin. Diarrhoea management: 2,335 (30.5%) child visits were for diarrhoea with 2,068 (88.6%) correctly treated with oral rehydration salts and zinc sulphate. Dual/Triple classification: 2,387 (31.1%) children had both malaria and pneumonia and 664 (8.7%) were classified as having three illnesses. Over 90% of the children with dual or triple classification were treated appropriately. Meanwhile, 381 children were categorized as severely sick (with a danger sign) with 309 (81.1%) of them referred for appropriate management.

CONCLUSION: With the introduction of the iCCM intervention at drug shops in Eastern Uganda, it was possible to achieve high adherence to the treatment protocols, which is likely compatible with increased quality of care.

128. High prevalence of antibiotic resistance in nasopharyngeal bacterial isolates from healthy children in rural Uganda: A cross-sectional study

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ABSTRACT

BACKGROUND: In Uganda, the main causes of death in children under 5 years of age are malaria and pneumonia—often due to delayed diagnosis and treatment. In preparation for a community case management intervention for pneumonia and malaria, the bacterial composition of the nasopharyngeal flora and its *in vitro* resistance were determined in children aged five or under to establish baseline resistance to commonly used antibiotics.

METHODS: In a population-based survey in April 2008, nasopharyngeal specimens were collected from 152 randomly selected healthy children under 5 years of age in the Iganga/Mayuge Health and Demographic Surveillance Site (HDSS). Medical history and prior treatment were recorded. Demographic characteristics and risk factors for carriage of resistant strains were obtained from the HDSS census. Bacteria were isolated and analysed for antibiotic susceptibility using disk diffusion and E test.

RESULTS: *Streptococcus pneumoniae* (*S. pneumoniae*) carriage was 58.6%, and, while most (80.9%) isolates had intermediate resistance to penicillin, none was highly resistant. Whereas no isolate was resistant to erythromycin, 98.9% were resistant to trimethoprim-sulphamethoxazole (co-trimoxazole).

CONCLUSIONS: *In vitro* resistance in *S. pneumoniae* to co-trimoxazole treatment was high, and the majority of isolates had intermediate resistance to penicillin. To inform treatment policies on the clinical efficacy of current treatment protocols for pneumonia in health facilities and at the community level, routine surveillance of resistance in pneumonia pathogens is needed as well as research on treatment efficacy in cases with resistant strains. Improved clinical algorithms and diagnostics for pneumonia should be developed.

Key words: Antibiotic resistance, children, community case management, pneumonia, *Streptococcus pneumoniae*

129. Household management of acute respiratory infections in children under five years in Kampala Uganda

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ABSTRACT

Acute respiratory tract infections (ARI) are the leading cause of deaths among the under-five children in sub-Saharan Africa. The irrational self-medication of childhood ARIs at households in Uganda delays access to quality healthcare. Limited studies focus on strengthening household management of ARI. This study evaluated the household management of ARI among children under five years of age with ARIs in Kampala, Uganda. This study used a descriptive cross-sectional observational design. Households in Kampala were targeted in five divisions using the world health organization (WHO) 30 cluster method of sampling between June and July, 2011. Participants were invited to respond to a standardized questionnaire. The main outcome variable was management practices of ARI in children under-five years. Data were managed using Epidata V3.1 and exported to statistical package of social sciences (SPSS) v19 for quantitative analysis. Out of the 200 households interviewed, the majority 196 (98%) reported at least one episode of ARI in the last four weeks. The common cold with cough was the most common ARI syndrome 98 (49%; $p < 0.001$). 93 (46.5%; $p = 0.322$) cases of ARI were considered to be appropriately managed. The prescribing of antibiotics 86 (43%; $p < 0.001$), 25 (12.5%; $p < 0.001$) antimalarials and dexamethasone 10 (5%; $p < 0.001$) was common. The appropriate management of the ARI at households was associated with frequency of the ARI, pneumonia symptoms, level of education of caretaker and source of the medicines. The prevalence of ARI among children under five years in Kampala is high. The management of ARIs among the under-fives in Kampala is suboptimal with misuse of antibiotics, antimalarials, dexamethasone, herbal medicines and cough remedies common. There is a need for household guidelines for management of ARI and related conditions. Community based programs are urgently required to empower parents of children in management of ARIs.

Key words: Acute respiratory infections, household management, Kampala-Uganda.

130. Impact of an integrated community case management programme on uptake of appropriate diarrhoea and pneumonia treatments in Uganda: A propensity score matching and equity analysis study

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ABSTRACT

INTRODUCTION: Pneumonia and diarrhoea disproportionately affect children in resource-poor settings. Integrated community case management (iCCM) involves community health workers treating diarrhoea, pneumonia and malaria. Studies on impact of iCCM on appropriate treatment and its effects on equity in access to the same are limited. The objective of this study was to measure the impact of integrated community case management (iCCM) as the first point of care on uptake of appropriate treatment for children with a classification of pneumonia (cough and fast breathing) and/or diarrhoea and to measure the magnitude and distribution of socioeconomic status related inequality in use of iCCM.

METHODS: Following introduction of iCCM, data from cross-sectional household surveys were examined for socioeconomic inequalities in uptake of treatment and use of iCCM among children with a classification of pneumonia or diarrhoea using the Erreygers' corrected concentration index (CCI). Propensity score matching methods were used to estimate the average treatment effects on the treated (ATT) for children treated under the iCCM programme with recommended antibiotics for pneumonia, and ORS plus or minus zinc for diarrhoea.

FINDINGS: Overall, more children treated under iCCM received appropriate antibiotics for pneumonia (ATT = 34.7%, $p < 0.001$) and ORS for diarrhoea (ATT = 41.2%, $p < 0.001$) compared to children not attending iCCM. No such increase was observed for children receiving ORS-zinc combination (ATT = -0.145, $p < 0.05$). There were no obvious inequalities in the uptake of appropriate treatment for pneumonia among the poorest and least poor (CCI = -0.070; SE = 0.083). Receiving ORS for diarrhoea was more prevalent among the least poor groups (CCI = 0.199; SE = 0.118). The use of iCCM for pneumonia was more prevalent among the poorest groups (CCI = -0.099; SE = 0.073). The use of iCCM for diarrhoea was not significantly different among the poorest and least poor (CCI = -0.073; SE = 0.085).

CONCLUSION: iCCM is a potentially equitable strategy that significantly increased the uptake of appropriate antibiotic treatment for pneumonia and ORS for diarrhoea, but not the uptake of zinc for diarrhoea. For maximum impact, interventions increasing zinc uptake should be considered when scaling up iCCM programmes.

Keywords: Integrated community case management, Pneumonia, Diarrhoea, Equity, Treatment

131. Trends in prevalence of diarrhoea, Kaposi's sarcoma, bacterial pneumonia, malaria and geohelminths among HIV positive individuals in Uganda

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ABSTRACT

BACKGROUND: Trends in prevalence of opportunistic infections (OIs) associated with the human immunodeficiency virus (HIV) in resource poor settings have previously not been well documented. The objective of this study was to describe the trends in prevalence of Diarrhoea, Bacterial pneumonia, Kaposi's sarcoma, Malaria and Geohelminths among HIV positive individuals over a 12 year period in Uganda.

METHODS: Observation data for 5972 HIV positive individuals enrolled with the AIDS support organisation (TASO) in Uganda were analysed. Study participants were drawn from three HIV clinics located in different geographical areas of Uganda and followed from January 2002 to December 2013. The prevalence trends for the above OIs were plotted using the Box Jenkins moving average technique. χ^2 -test for trend was used to test for the significance of the trends and Pearson's correlation coefficient used to test for the strength of linear relationship between OI prevalence and calendar time. Mixed effect linear regression was used to estimate average monthly change in prevalence with monthly variation modelled as a random effect.

RESULTS: A total of 204,871 monthly medical reports were retrieved and analysed. 73 % (4301/5972) were female with a median age of 32 years (inter-quartile range 26–39). Overall, significant decreasing mean annual prevalence trends ($p < 0.05$, χ^2 trend) were observed for Diarrhoea (< 0.05) by HIV clinic for Diarrhoea (< 1 month) with Pearson's correlation coefficient ($r = -0.89$), Malaria ($r = -0.75$), Bacterial Pneumonia ($r = -0.52$), and Geohelminth ($r = -0.32$). Non-significant increasing mean annual prevalence trend was observed for Kaposi sarcoma ($p = 0.20$, χ^2 trend; $r = +0.26$). After adjusting for age, sex and clinic in a mixed effects linear regression model, average monthly prevalence declined significantly at a rate of 0.4 % for Kaposi sarcoma, 0.3 % for Geohelminths, 2 % for Malaria, 1 % for Bacterial Pneumonia and 3 % for Diarrhoea (< 0.05) by HIV clinic for Diarrhoea (< 1 month), and age, sex and clinic for malaria.

CONCLUSIONS AND RECOMMENDATIONS: Overall, decreasing trends were observed in the above OIs. However, the trends differed significantly by OI, geographical location and demographic characteristics. There is urgent need to integrate interventions targeting malaria and geohelminths in HIV programmes.

132. Clinical outcomes of children with acute asthma and pneumonia in Mulago hospital, Uganda: a prospective study

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ABSTRACT

BACKGROUND: Little attention has been paid to asthma in 'under-fives' in Sub-Saharan Africa. In 'under-fives', acute asthma and pneumonia have similar clinical presentation and most children with acute respiratory symptoms are diagnosed with pneumonia according to the WHO criteria. The mortality associated with acute respiratory diseases in Uganda is high but improving, dropping from 24% in 2004 to 11.9% in 2012. We describe the immediate clinical outcomes of children with acute asthma and pneumonia and document the factors associated with prolonged hospitalization and mortality. **Methods:** We enrolled 614 children aged 2 to 59 months with acute respiratory symptoms presenting at the emergency paediatric unit of Mulago hospital. Clinical histories, physical examination, blood and radiological tests were done. Children with asthma and bronchiolitis were collectively referred to as 'Asthma syndrome'. Hospitalized children were monitored every 12 hours for a maximum of 7 days. Survival analysis was done to compare outcome of children with asthma and pneumonia. Cox regression analysis was done to determine factors associated with prolonged hospitalization and mortality.

RESULTS: Overall mortality was 3.6%. The highest case fatality was due to pneumocystis jirovecii pneumonia (2/4) and pulmonary tuberculosis (2/7). None of the children with asthma syndrome died. Children with 'asthma syndrome' had a significantly shorter hospital stay compared to those with pneumonia ($p < 0.001$). Factors independently associated with mortality included hypoxemia (HR = 10.7, 95% CI 1.4- 81.1) and severe malnutrition (HR = 5.7, 95% CI 2.1- 15.8). Factors independently associated with prolonged hospitalization among children with asthma syndrome included age less than 12 months (RR = 1.2, 95% CI 1.0-1.4), hypoxemia (RR = 1.4, 95% CI 1.2-1.7), and severe malnutrition (RR = 1.5 95% CI 1.3-1.8). Similar factors were associated with long duration of hospital stay among children with pneumonia.

CONCLUSION: This study identified a sharp decline in acute respiratory mortality compared to the previous studies in Mulago hospital. This may be related to focus on and treatment of asthma in this study, and will be analysed in a later study. Bacterial pneumonia is still associated with high case fatality. Hypoxemia, severe malnutrition, and being an infant were associated with poor prognosis among children with acute asthma and pneumonia and need to be addressed in the management protocols.

Keywords: Asthma, Pneumonia, 'Under-fives', Duration of hospitalization, Mortality

133. Co-infection of malaria and influenza viruses in Uganda: A pilot study

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ABSTRACT

BACKGROUND: Influenza is a highly contagious viral infection of the respiratory passages causing fever, headache, severe aching, cough, and periodically causes epidemics especially in temperate environments. In many African countries, people do not visit clinics or hospitals with just influenza infection. Majority of ILI patients do not seek medical care and very few of those who do, get tested for influenza. The many of influenza cases that are reported by surveillance programs are from sentinel sites where patients come in with other medical problems. Clinically, influenza is not distinguishable from most other infectious diseases with fever in the tropics. Malaria is an important infectious disease and is still thought to be the main cause of febrile episodes. Most fevers are thought to be malaria. Our investigations sort to establish information on incidence of malaria in patients who are positive with Influenza infection.

METHODS & MATERIALS: This cross-sectional pilot study examined incidence of malaria among outpatient visits and hospitalizations associated with Influenza like Illnesses (ILI) and Severe Acute Respiratory Illness (SARI) during the period February 2011 -November 2013 in children, youth and adults attending six health facilities of; Kawaala health centre III, Kitebi Health centre III, UVRI Clinic, Entebbe Hospital and Mbarara Regional referral hospital in Uganda. Nasopharyngeal and oropharyngeal swabs were collected from patients meeting the WHO case definition for ILI and SARI. Influenza viruses were screened for using RT-PCR and the clinical data presenting diagnosis of malaria was collected and analyzed.

RESULTS: Out of the 1020 influenza specimens collected from cases; 754 (73.9%) patients were diagnosed with malaria; 116 (15%) of 754 were positive for Influenza and 638 (84.6%) were negative; positive for Influenza A were 71 (9.4%) with two subtypes; 56 (7.4%) A(H3) and 15 (2.6%) Pandemic A(H1N1) 2009, and 45 (6.0%) were Influenza B viruses. Of the 116 positives 108 (93.1%) were ILI and 8 (6.9%) were SARI patients. Although 107 (92.2%) Children diagnosed with Malaria had Influenza, 9 (7.8%) Youth had Influenza whereas there was no Influenza in Adult.

CONCLUSION: Our data shows a high incidence of Influenza in children diagnosed with malaria.

134. Household health care-seeking costs: experiences from a randomized, controlled trial of community-based malaria and pneumonia treatment among under-fives in eastern Uganda

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ABSTRACT

BACKGROUND: Home and community-based combined treatment of malaria and pneumonia has been promoted in Uganda since mid 2011. The combined treatment is justified given the considerable overlap between the symptoms of malaria and pneumonia among infants. There is limited evidence about the extent to which community-based care reduces healthcare-seeking costs at the household level in rural and urban settings. This paper assesses the rural–urban differences in direct and indirect costs of seeking care from formal health facilities compared to community medicine distributors (CMDs).

METHODS: Exit interviews were conducted for 282 (159 rural and 123 urban) caregivers of children below five years who had received treatment for fever-related illnesses at selected health centres in Iganga and Mayuge districts. Data on the direct and indirect costs incurred while seeking care at the health centre visited were obtained. Using another tool, household level direct and indirect costs of seeking care from CMDs were collected from a total of 470 caregivers (304 rural and 166 urban). Costs incurred at health facilities were then compared with costs of seeking care from CMDs.

RESULTS: Household direct costs of seeking care from health facilities were significantly higher for urban-based caregivers than the rural (median cost = US\$0.42 for urban and zero for rural; $p < 0.0001$). The same is true for seeking care from CMDs ($p = 0.0038$). Overall, caregivers travelled for an average of 75 min to reach health centres and spent an average of 80 min at the health centre while receiving treatment. However, households in rural areas travelled for a significantly longer time ($p < 0.001$) to reach health care facilities than the urban-based caregivers. Besides travelling longer distances, rural caregivers spent 150 min seeking care from health facilities compared to 30 min from CMDs.

CONCLUSION: Time and monetary savings for seeking care from CMDs are significantly larger for rural than urban households. Thus, home and community-based treatment of child febrile illnesses is much more cost-saving for rural poor communities, who would spend more time travelling to health facilities - which time could be re-directed to productive and income-generating activities.

Keywords: Household cost, Health care-seeking, Malaria, Pneumonia

135. Increased Access to Care and Appropriateness of Treatment at Private Sector Drug Shops with Integrated Management of Malaria, Pneumonia and Diarrhoea: A Quasi-Experimental Study in Uganda

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ABSTRACT

INTRODUCTION: Drug shops are a major source of care for children in low income countries but they provide sub-standard care. We assessed the feasibility and effect on quality of care of introducing diagnostics and pre-packaged paediatric dosage drugs for malaria, pneumonia and diarrhoea at drug shops in Uganda.

METHODS: We adopted and implemented the integrated community case management (iCCM) intervention within registered drug shops. Attendants were trained to perform malaria rapid diagnostic tests (RDTs) in each fever case and count respiratory rate in each case of cough with fast/difficult breathing, before dispensing recommended treatment. Using a quasi-experimental design in one intervention and one non-intervention district, we conducted before and after exit interviews for drug seller practices and household surveys for treatment-seeking practices in May–June 2011 and May–June 2012. Survey adjusted generalized linear models and difference-in-difference analysis was used.

RESULTS: 3759 (1604 before/2155 after) household interviews and 943 (163 before/ 780 after) exit interviews were conducted with caretakers of children under-5. At baseline, no child at a drug shop received any diagnostic testing before treatment in both districts. After the intervention, while no child in the non-intervention district received a diagnostic test, 87.7% (95% CI 79.0–96.4) of children with fever at the intervention district drug shops had a parasitological diagnosis of malaria, prior to treatment. The prevalence ratios of the effect of the intervention on treatment of cough and fast breathing with amoxicillin and diarrhoea with ORS/zinc at the drug shop were 2.8 (2.0–3.9), and 12.8 (4.2–38.6) respectively. From the household survey, the prevalence ratio of the intervention effect on use of RDTs was 3.2 (1.9– 5.4); Artemisinin Combination Therapy for malaria was 0.74 (0.65–0.84), and ORS/ zinc for diarrhoea was 2.3 (1.2–4.7).

CONCLUSION: iCCM can be utilized to improve access and appropriateness of care for children at drug shops.

136. Performance of community health workers managing malaria, pneumonia and diarrhoea under the community case management programme in central Uganda: a cross sectional study

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ABSTRACT

BACKGROUND: Lay community health workers (CHWs) have been widely used to provide curative interventions in communities that have traditionally lacked access to health care. Optimal performance of CHWs managing children with malaria, pneumonia and diarrhoea in communities is desired if a reduction in childhood morbidity and mortality is to be achieved. This study assessed factors influencing performance of CHWs managing malaria, pneumonia and diarrhoea under the Integrated Community Case Management (iCCM) programme in Wakiso district, central Uganda.

METHODS: A cross sectional study was conducted among 336 CHWs. Data was collected using interviews and record reviews. Performance was measured using composite scores based on the core activities of CHWs under the iCCM programme. These core activities included: treating children under five years, referring severely sick children including newborns, home visits, counseling caregivers on home care, record keeping and community sensitization. Descriptive and inferential statistics using odds ratios were done to determine factors influencing performance of CHWs.

RESULTS: Of the 336 respondents, 242 (72%) were females and the overall level of good performance was 21.7% (95% CI, 17.3-26.1%). Factors significantly associated with performance were: sex (females) (AOR 2.65; 95% CI, 1.29 -5.43), community support (AOR 2.29; 95% CI, 1.27-4.14), receiving feedback from health facilities (AOR 4.90; 95% CI, 2.52-9.51) and having drugs in the previous three months (AOR 2.99; 95% CI, 1.64-5.42).

CONCLUSION: Only one in every five CHWs performed optimally under the iCCM programme. Strategies to improve drug supply, community support and feedback provision from the formal health system are necessary to improve the performance of CHWs.

Keywords: CHWs, iCCM programme, Performance, Evaluation, Uganda

137. Pneumonia among children under five in Uganda: symptom recognition and actions taken by caretakers

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ABSTRACT

BACKGROUND: Pneumonia is a leading cause of death among children under five years of age. Pneumonia deaths could be averted if caretakers recognized the danger signs and sought appropriate treatment promptly.

METHODS: We interviewed 278 caretakers in Mukono district Uganda, whose under-five children had suffered from probable pneumonia two weeks prior to the evaluation. Through structured questionnaires we assessed caretaker's knowledge about danger signs among under-five children with pneumonia and the actions taken to manage probable pneumonia using descriptive statistics. We also conducted in-depth interviews with caretakers and community health workers.

RESULTS: Lower chest wall in drawing (a pneumonia specific danger sign) was mentioned by only 9.4% of the caretakers. Among the Integrated Management of Childhood Illnesses (IMCI) standard general danger signs, inability to feed was the most commonly cited danger sign (37.8%) followed by incessant vomiting (10.1%). No caretaker mentioned all the four standard general danger signs. In terms of actions taken, most caretakers offered drinks (49.6%) and traditional herbs (45.3%) while, 31.7% gave antibiotics.

CONCLUSIONS: Caretaker's knowledge about danger signs was inadequate in relation to the IMCI guidelines. Caretakers used both modern and traditional forms of treatment to manage pneumonia. Comprehensive interventions geared at increasing symptom recognition and improving health-seeking behavior are needed to reverse this trend.

Keywords: Pneumonia, Knowledge, Dangers signs, Care seeking, Uganda.

138. The Lung Microbiome of Ugandan HIV-Infected Pneumonia Patients Is Compositionally and Functionally Distinct from That of San Franciscan Patients

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ABSTRACT

Sub-Saharan Africa represents 69% of the total number of individuals living with HIV infection worldwide and 72% of AIDS deaths globally. Pulmonary infection is a common and frequently fatal complication, though little is known regarding the lower airway microbiome composition of this population. Our objectives were to characterize the lower airway microbiome of Ugandan HIV-infected patients with pneumonia, to determine relationships with demographic, clinical, immunological, and microbiological variables and to compare the composition and predicted metagenome of these communities to a comparable cohort of patients in the US (San Francisco). Bronchoalveolar lavage samples from a cohort of 60 Ugandan HIV-infected patients with acute pneumonia were collected. Amplified 16S ribosomal RNA was profiled and aforementioned relationships examined. Ugandan airway microbiome composition and predicted metagenomic function were compared to US HIV-infected pneumonia patients. Among the most common bacterial pulmonary pathogens, *Pseudomonas aeruginosa* was most prevalent in the Ugandan cohort. Patients with a richer and more diverse airway microbiome exhibited lower bacterial burden, enrichment of members of the Lachnospiraceae and sulfur-reducing bacteria and reduced expression of TNF-alpha and matrix metalloproteinase-9. Compared to San Franciscan patients, Ugandan airway microbiome was significantly richer, and compositionally distinct with predicted metagenomes that encoded a multitude of distinct pathogenic pathways e.g secretion systems. Ugandan pneumonia-associated airway microbiome is compositionally and functionally distinct from those detected in comparable patients in developed countries, a feature which may contribute to adverse outcomes in this population.

139. Asthma and Pneumonia among Children Less Than Five Years with Acute Respiratory Symptoms in Mulago Hospital, Uganda: Evidence of Under-Diagnosis of Asthma

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ABSTRACT

BACKGROUND: Pneumonia is considered the major cause of mortality among children with acute respiratory disease in low-income countries but may be over-diagnosed at the cost of under-diagnosing asthma. We report the magnitude of asthma and pneumonia among “under-fives” with cough and difficulty breathing, based on stringent clinical criteria. We also describe the treatment for children with acute respiratory symptoms in Mulago Hospital.

METHODS: We enrolled 614 children aged 2–59 months with cough and difficulty breathing. Interviews, physical examination, blood and radiological investigations were done. We defined

asthma according to Global Initiative for Asthma guidelines. Pneumonia was defined according to World Health Organization guidelines, which were modified by including fever and white cell count, C-reactive protein, blood culture and chest x-ray. Children with asthma or bronchiolitis were collectively referred to as “asthma syndrome” due to challenges of differentiating the two conditions in young children. Three pediatricians reviewed each participant’s case report post hoc and made a diagnosis according to the study criteria.

RESULTS: Of the 614 children, 41.2% (95% CI: 37.3–45.2) had asthma syndrome, 27.2% (95% CI: 23.7–30.9) had bacterial pneumonia, 26.5% (95% CI: 23.1–30.2) had viral pneumonia, while 5.1% (95% CI: 3.5–7.1) had other diagnoses including tuberculosis. Only 9.5% of the children with asthma syndrome had been previously diagnosed as asthma. Of the 253 children with asthma syndrome, 95.3% (95% CI: 91.9–97.5) had a prescription for antibiotics, 87.7% (95% CI: 83.1–91.5) for bronchodilators and 43.1% (95% CI: 36.9–49.4) for steroids.

CONCLUSION: Although reports indicate that acute respiratory symptoms in children are predominantly due to pneumonia, asthma syndrome contributes a significant proportion. Antibiotics are used irrationally due to misdiagnosis of asthma as pneumonia. There is need for better diagnostic tools for childhood asthma and pneumonia in Uganda.

140. Integrated community case management of malaria and pneumonia increases prompt and appropriate treatment for pneumonia symptoms in children under five years in Eastern Uganda

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Malaria Journal 2013, 12:340 <http://www.malariajournal.com/content/12/1/340>

ABSTRACT

BACKGROUND: Efforts to improve access to treatment for common illnesses in children less than five years initially targeted malaria alone under the home management of malaria strategy.

However, under this strategy, children with other illnesses were often wrongly treated with anti-malarials. Integrated community case management of common childhood illnesses is now recommended but its effect on promptness of appropriate pneumonia treatment is unclear. Objectives: To determine the effect of integrated malaria and pneumonia management on receiving prompt and appropriate antibiotics for pneumonia symptoms and treatment outcomes as well as determine associated factors.

METHODS: A follow-up study was nested within a cluster-randomized trial that compared under-five mortality in areas where community health workers (CHWs) treated children with malaria and pneumonia (intervention areas) and where they treated children with malaria only (control areas). Children treated by CHWs were enrolled on the day of seeking treatment from CHWs (609 intervention, 667 control) and demographic, illness, and treatment seeking information was collected. Further information on illness and treatment outcomes was collected on day four. The primary outcome was prompt and appropriate antibiotics for pneumonia symptoms and the secondary outcome was treatment outcomes on day four.

RESULTS: Children in the intervention areas were more likely to receive prompt and appropriate antibiotics for pneumonia symptoms compared to children in the control areas (RR = 3.51, 95%CI = 1.75-7.03). Children in the intervention areas were also less likely to have temperature $\geq 37.5^{\circ}\text{C}$ on day four (RR = 0.29, 95%CI = 0.11-0.78). The decrease in fast breathing between day one and four was greater in the intervention (9.2%) compared to the control areas (4.2%, p-value = 0.01).

CONCLUSIONS: Integrated community management of malaria and pneumonia increases prompt and appropriate treatment for pneumonia symptoms and improves treatment outcomes. Trial registration: ISRCTN: ISRCTN52966230

Keywords: CHW, ICCM, Health System Research, Prompt treatment, Appropriate treatment, Treatment outcomes, Malaria, Pneumonia, Children, CMDs

141. Asthma and Pneumonia among Children Less Than Five Years with Acute Respiratory Symptoms in Mulago Hospital, Uganda: Evidence of Under-Diagnosis of Asthma

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PLoS ONE 8(11): e81562. doi: 10.1371/journal.pone.0081562 Published November 29, 2013

ABSTRACT

BACKGROUND: Pneumonia is considered the major cause of mortality among children with acute respiratory disease in low-income countries but may be over-diagnosed at the cost of under-diagnosing asthma. We report the magnitude of asthma and pneumonia among “under-fives” with cough and difficulty breathing, based on stringent clinical criteria. We also describe the treatment for children with acute respiratory symptoms in Mulago Hospital.

METHODS: We enrolled 614 children aged 2–59 months with cough and difficulty breathing. Interviews, physical examination, blood and radiological investigations were done. We defined asthma according to Global Initiative for Asthma guidelines. Pneumonia was defined according to World Health Organization guidelines, which were modified by including fever and white cell count, C-reactive protein, blood culture and chest x-ray. Children with asthma or bronchiolitis were collectively referred to as “asthma syndrome” due to challenges of differentiating the two conditions in young children. Three pediatricians reviewed each participant’s case report post hoc and made a diagnosis according to the study criteria.

RESULTS: Of the 614 children, 41.2% (95% CI: 37.3–45.2) had asthma syndrome, 27.2% (95% CI: 23.7–30.9) had bacterial pneumonia, 26.5% (95% CI: 23.1–30.2) had viral pneumonia, while 5.1% (95% CI: 3.5–7.1) had other diagnoses including tuberculosis. Only 9.5% of the children with asthma syndrome had been previously diagnosed as asthma. Of the 253 children with asthma syndrome, 95.3% (95% CI: 91.9–97.5) had a prescription for antibiotics, 87.7% (95% CI: 83.1–91.5) for bronchodilators and 43.1% (95% CI: 36.9–49.4) for steroids.

CONCLUSION: Although reports indicate that acute respiratory symptoms in children are predominantly due to pneumonia, asthma syndrome contributes a significant proportion. Antibiotics are used irrationally due to misdiagnosis of asthma as pneumonia. There is need for better diagnostic tools for childhood asthma and pneumonia in Uganda.

142. Clinic- and Hospital-Based Sentinel Influenza Surveillance, Uganda 2007–2010

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ABSTRACT

BACKGROUND: To assess the epidemiology and seasonality of influenza in Uganda, we established a sentinel surveillance system for influenza in 5 hospitals and 5 outpatient clinics in 4 geographically distinct regions, using standard case definitions for influenzalike illness (ILI) and severe acute respiratory illness (SARI).

METHODS: Nasopharyngeal and oropharyngeal specimens were collected from April 2007 through September 2010 from patients with ILI and SARI aged ≥ 2 months, tested for influenza A and B with real-time reverse-transcription polymerase chain reaction, and subtyped for seasonal A/H1, A/H3, A/H5, and 2009 pandemic influenza A (pH1N1).

RESULTS: Among the 2758 patients sampled, 2656 (96%) enrolled with ILI and 101 (4%) with SARI. Specimens from 359 (13.0%) were positive for influenza; 267 (74.4%) were influenza A, and 92 (25.6%) were influenza B. The median age of both patients with ILI and patients with SARI was 4 years (range, 2 months to 67 years); patients aged 5–14 years had the highest influenza-positive percentage (19.6%), and patients aged 0–4 years had the lowest percentage (9.1%). Influenza circulated throughout the year, but the percentage of influenza-positive specimens peaked during June–November, coinciding with the second rainy season.

CONCLUSIONS: Continued and increased surveillance is needed to better understand the morbidity and mortality of influenza in Uganda.

143. Low prevalence of *Pneumocystis jirovecii* lung colonization in Ugandan HIV-infected patients hospitalized with non-*Pneumocystis* pneumonia

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Diagn Microbiol Infect Dis. 2012 February; 72(2): 139–143. doi: 10.1016/j.diagmicrobio.2011.10.009.

ABSTRACT

Pneumocystis jirovecii is an important opportunistic infection in HIV-infected patients. In the developed world, *P. jirovecii* epidemiology is marked by frequent colonization in immunosuppressed patients, but data on the prevalence of colonization is very limited in sub-Saharan Africa, where the majority of persons living with HIV reside. Our objective was to describe the epidemiology of *P. jirovecii* colonization among HIV-positive patients in a cross-sectional, hospital-based study of patients admitted with suspected pneumonia in Kampala, Uganda. *P. jirovecii* was detectable in bronchoalveolar lavage fluid from 7 of 124 (6%) consecutive patients with non-*Pneumocystis* pneumonia. Colonization was not associated with patient demographic or clinical information. This prevalence is substantially lower than in published studies in the developed world, and suggests that there is a limited reservoir of organisms for clinical infections in this Ugandan population. These findings may partially explain the low incidence of *Pneumocystis* pneumonia in Uganda and other sub-Saharan African countries.

144. Use of Community Health Workers for Management of Malaria and Pneumonia in Urban and Rural Areas in Eastern Uganda

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Am. J. Trop. Med. Hyg., 87(Suppl 5), 2012, pp. 30–35 doi:10.4269/ajtmh.2012.11-0732

ABSTRACT.

Use of community health workers (CHWs) has been implemented the same way in urban and rural areas despite differences in availability of health providers and sociodemographic characteristics. A household survey was conducted in rural and urban areas in eastern Uganda, and all children who were febrile in the previous two weeks were assessed for their symptoms, treatment received at home, and when and where they first went for treatment. Rural children were more likely to use CHWs than urban children. Urban children received outside treatment more promptly, and used herbs at home less. Symptoms and proportion of children being taken out for treatment were similar. Children from the poorest households used CHWs less and private providers more than the middle quintiles. Drug shops and private clinics should be included in the community case management to cater for the poorest in rural areas and persons in urban areas.

145. Zinc adjunct therapy reduces case fatality in severe childhood pneumonia: a randomized double blind placebo-controlled trial

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BMC Medicine 2012, 10:14 <http://www.biomedcentral.com/1741-7015/10/14>

ABSTRACT

BACKGROUND: Pneumonia is a leading cause of children's deaths in developing countries and hinders achievement of the fourth Millennium Development Goal. This goal aims to reduce the under-five mortality rate, by two thirds, between 1990 and 2015. Few studies have examined the impact of zinc adjunct therapy on the outcome of childhood pneumonia. We determined the effect of zinc as adjunct therapy on time to normalization of respiratory rate, temperature and oxygen saturation. We also studied the effect of zinc adjunct therapy on case fatality of severe childhood pneumonia (as a secondary outcome) in Mulago Hospital, Uganda.

METHODS: In this double blind, randomized, placebo-controlled clinical trial, 352 children aged 6 to 59 months, with severe pneumonia were randomized to zinc (20 mg for children ≥ 12 months, and 10 mg for those < 12 months) or a placebo once daily for seven days, in addition to standard antibiotics for severe pneumonia. Children were assessed every six hours. Oxygen saturation was normal if it was above 92% (breathing room air) for more than 15 minutes. The respiratory rate was normal if it was consistently (more than 24 hours) below 50 breaths per minute in infants and 40 breaths per minute in children above 12 months of age. Temperature was normal if consistently below 37.5°C. The difference in case fatality was expressed by the risk ratio between the two groups.

RESULTS: Time to normalization of the respiratory rate, temperature and oxygen saturation was not significantly different between the two arms. Case fatality was 7/176 (4.0%) in the zinc group and 21/176 (11.9%) in the placebo group: Relative Risk 0.33 (95% CI 0.15 to 0.76). Relative Risk Reduction was 0.67 (95% CI 0.24 to 0.85), while the number needed to treat was 13. Among HIV infected children, case fatality was higher in the placebo (7/27) than in the zinc (0/28) group; RR 0.1 (95% CI 0.0, 1.0). Among 127 HIV uninfected children receiving the placebo, case fatality was 7/127 (5.5%); versus 5/129 (3.9%) among HIV uninfected group receiving zinc: RR 0.7 (95% CI 0.2, 2.2). The excess risk of death attributable to the placebo arm (Absolute Risk Reduction or ARR) was 8/100 (95% CI: 2/100, 14/100) children. This excess risk was substantially greater among HIV positive children than in HIV negative children (ARR: 26 (95% CI: 9, 42) per 100 versus 2 (95% CI: -4, 7) per 100); P-value for homogeneity of risk differences = 0.006.

CONCLUSION: Zinc adjunct therapy for severe pneumonia had no significant effect on time to normalization of the respiratory rate, temperature and oxygen saturation. However, zinc supplementation in these children significantly decreased case fatality.

146. Can lay community health workers be trained to use diagnostics to distinguish and treat malaria and pneumonia in children? Lessons from rural Uganda

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Tropical Medicine and International Health doi:10.1111/j.1365-3156.2011.02831.x, volume 16 no 10 pp 1234–1242 October 2011

ABSTRACT

OBJECTIVE: To determine the competence of community health workers (CHWs) to correctly assess, classify and treat malaria and pneumonia among under-five children after training.

METHODS: Consultations of 182 under-fives by 14 CHWs in Iganga district, Uganda, were observed using standardised checklists. Each CHW saw 13 febrile children. Two paediatricians observed CHWs' assessment, classification and prescription of treatment, while a laboratory scientist assessed CHW use of malaria rapid diagnostic tests (RDTs). The validity of CHWs' use of RDTs to detect malaria and respiratory timers to diagnose pneumonia was estimated using a laboratory scientist's RDT repeat reading and a paediatrician's repeat count of the respiratory rate, respectively.

RESULTS: From the 182 consultations, overall CHWs' performance was adequate in taking history (97%), use (following procedures prior to reading result) of timers (96%) and use of RDTs (96%), but inadequate in classification (87%). Breath readings (classified as fast or normal) were 85% in agreement with the paediatrician ($\kappa = 0.665$, $P < 0.001$). All RDT readings were in agreement with those obtained by the laboratory scientist. Ninety-six per cent (85/89) of children with a positive RDT were prescribed an antimalarial drug, 40% (4/10) with fast breathing (gold standard) were prescribed an antibiotic and 91% (48/53) with both were prescribed both medicines.

CONCLUSION: Community health workers can be trained to use RDTs and timers to assess and manage malaria and pneumonia in children. We recommend integration of these diagnostics into community case management of fever. CHWs require enhanced practice in counting respiratory

rates and simple job aides to enable them make a classification without thinking deeply about several assessment results.

Keywords community health worker, performance, integrated community case management for malaria and pneumonia, diagnostics, rapid diagnostic test, respiratory rate timer, Uganda

147. Determinants of diarrhoea and acute respiratory infection among under-fives in Uganda

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ABSTRACT

BACKGROUND: Diarrhoea and acute respiratory infection (ARI) are leading causes of mortality and morbidity in children under the age of five in developing countries. On the African continent, pneumonia (14%) and diarrhoea (17%) cause more child deaths than Malaria (16%), HIV/AIDS (4%), and measles (1%) combined. This paper set out to investigate the factors associated with the occurrence of diarrhoea and ARI incidence for children under five years in Uganda.

METHOD: We used a nationally representative Uganda Demographic and Health Survey (UDHS) (2006). Sampling was done in two stages. In the first stage 321 clusters were selected from among a list of clusters sampled in the 2005/06 Uganda National Household Survey (UNHS), 17 clusters from the 2002 Census frame from Karamoja, and 30 internally displaced camps (IDPs). In the second stage, households in each cluster were selected as per UNHS listing. In addition 20 households were randomly selected in each cluster. Questionnaires were used during data collection. During the analysis, a maximum likelihood probit model was used in order to ascertain the probability of occurrence of diseases.

RESULTS: On average, 32% and 48% of children in the survey suffered from diarrhoea and ARI in the two weeks prior to the survey date. The occurrence was concentrated amongst children aged 0–24 months. Mother's education, especially at post-secondary level, reduced the probability of diarrhoea occurrence but had no effect on ARI occurrence. First hour initiation and exclusive breastfeeding reduced the probability occurrence of both diarrhoea and ARI. Other significant factors associated with the occurrence of both diseases include: regional and location differentials, wealth status, type of dwelling, mother's occupation, child age, and child nutritional status.

CONCLUSION: Policy interventions should target female education, eliminate location and regional disadvantages, and educate the population to adopt breastfeeding practices recommended by the World Health Organization (WHO). The government should also ensure proper dwelling places for the population that are associated with favourable health outcomes. Other proper feeding practices together with breastfeeding (after six months), should be made

known to the masses so as to reduce the number of children that are malnourished and growth retarded.

Key Words: Diarrhoea, acute respiratory infections, children, under-five years, Uganda

148. Projected health benefits and costs of pneumococcal and rotavirus vaccination in Uganda

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ABSTRACT

We determined impact and cost-effectiveness of pneumococcal and rotavirus vaccination programs among children < 5 years of age in Uganda from the public health system perspective. Disease-specific models compared the disease burden and cost with and without a vaccination program. If introduced, pneumococcal and rotavirus vaccine programs will save 10,796 and 5265 lives, respectively, prevent 94,071 *Streptococcus pneumoniae* and 94,729 rotavirus cases in children < 5 years, and save 3886 and 996 million Ugandan shillings (\$2.3 and \$0.6 million US dollars), respectively, in direct medical costs annually. At the GAVI price (\$0.15/dose), pneumococcal vaccine will be cost-saving and rotavirus vaccine highly cost-effective.

149. The prevalence and clinical course of HIV-associated pulmonary cryptococcosis in Uganda

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Journal of Acquired Immune Deficiency Syndrome. 2010 July 1; 54(3): 269–274. doi:10.1097/QAI.0b013e3181ce6b19

ABSTRACT

BACKGROUND: The prevalence and clinical course of pulmonary cryptococcosis in Sub-Saharan Africa are not well-described.

Methods—Consecutive HIV-infected adults hospitalized at Mulago Hospital (Kampala, Uganda) between September 2007 and July 2008 with cough \geq 2 weeks were enrolled. Patients with negative sputum smears for acid-fast bacilli were referred for bronchoscopy with bronchoalveolar lavage (BAL). BAL fluid was examined for mycobacteria, *Pneumocystis jirovecii*, and fungi. Patients were followed two and six months after hospital discharge.

RESULTS: Of 407 patients enrolled, 132 (32%) underwent bronchoscopy. Of 132 BAL fungal cultures, 15 (11%) grew *Cryptococcus neoformans*. None of the patients were suspected to have pulmonary cryptococcosis on admission. The median CD4 count among those with pulmonary cryptococcosis was 23 cells/ μ L (IQR 7–51). Of 13 patients who completed six-month follow-up, four died and nine were improved, including five who had started antiretroviral therapy (ART) but had not received antifungal medication.

CONCLUSIONS: Pulmonary cryptococcosis is common in HIV-infected TB suspects in Uganda. Early initiation of ART in those with isolated pulmonary infection may improve outcomes, even without anti-fungal therapy. This finding suggests that some HIV-infected patients with *C. neoformans* isolated from respiratory samples may have colonization or localized infection.

Keywords Pulmonary Cryptococcosis; HIV/AIDS; Bronchoscopy

150. Respiratory Cryptosporidiosis in HIV-Seronegative Children in Uganda: Potential for Respiratory Transmission

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Clinical Infectious Diseases 2010; 50(10):1366–1372; 2010 by the Infectious Diseases Society of America. All rights reserved. 1058-4838/2010/5010-0006\$15.00 DOI: 10.1086/652140

ABSTRACT

BACKGROUND: Respiratory cryptosporidiosis is recognized as a late-stage complication in persons with human immunodeficiency virus (HIV) infection and AIDS. However, respiratory signs and symptoms are common in otherwise healthy children with intestinal cryptosporidiosis, which suggests that respiratory infection may occur in immunocompetent hosts.

METHODS: We recruited children 9–36 months of age who presented with diarrhea to Mulago Hospital in Kampala, Uganda, from November 2007 through January 2009. Children with stool samples positive or negative for *Cryptosporidium* species were selected for further evaluation, including sputum induction in those with cough or unexplained respiratory signs and collection of saliva and blood specimens. Sputum samples were subjected to comprehensive bacteriologic testing, and both sputum and saliva specimens were tested for *Cryptosporidium* species by nested polymerase chain reaction.

RESULTS: Of 926 fecal samples screened, 116 (12.5%) were positive for *Cryptosporidium*. Seventeen (35.4%) of 48 sputum samples tested from children with positive stool samples were positive for *Cryptosporidium*. Sixteen (94.1%) of the 17 children with confirmed respiratory cryptosporidiosis were HIV seronegative, and 10 (58.8%) of 17 children were not malnourished. None of the 12 sputum specimens from children with negative stool samples tested positive for *Cryptosporidium* (compared with children who tested positive for *P* .013 *Cryptosporidium* in the stool). Parasite DNA was detected in only 2 (1.9%) of 103 saliva samples (compared with sputum *P*! .001 samples).

CONCLUSIONS: Respiratory cryptosporidiosis was documented in one-third of HIV-seronegative children who were tested. These novel findings suggest the potential for respiratory transmission of cryptosporidiosis. Trial registration. ClinicalTrials.gov identifier: NCT00507871.

151. Action for child survival: elimination of *Haemophilus influenzae* type b meningitis in Uganda

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ABSTRACT

OBJECTIVE: To guide immunization policy, we determined the public health benefit of introducing *Haemophilus influenzae* type b (Hib) vaccine in Uganda and estimated the vaccine effectiveness.

METHODS: Surveillance data for acute bacterial meningitis among children aged 0–59 months were reviewed from three hospital sentinel sites, for July 2001 to June 2007, to determine the incidence of Hib meningitis, the effectiveness of Hib vaccine with a case-control design, and the number of vaccine-preventable cases and deaths of Hib disease in Uganda.

FINDINGS: Of the 13 978 children from 17 districts with suspected bacterial meningitis, 269 had confirmed Hib meningitis, declining from 69 patients in the prevaccine year (2001–2002) to three in 2006–2007. Hib meningitis incidence dropped from 88 cases per 100 000 children aged < 5 years in the year before vaccine introduction to 13 within 4 years, and to near zero in the fifth year. Vaccine effectiveness for 2 or more doses was 93% (95% confidence interval, CI: 69–99) against confirmed Hib meningitis and 53% (95% CI: 11–68) against purulent meningitis of unknown cause. In Uganda, Hib vaccine prevents an estimated 28 000 cases of pneumonia and meningitis, 5000 deaths and 1000 severe meningitis sequelae each year.

CONCLUSION: Infant immunization with Hib vaccine has virtually eliminated Hib meningitis in Uganda within 5 years. Ensuring long-term benefits of Hib vaccine urgently requires sustainable vaccine financing, high-quality ongoing surveillance, and a health sector able to deliver a robust immunization programme.

152. Bacterial aetiology and outcome in children with severe pneumonia in Uganda

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ABSTRACT

BACKGROUND: Pneumonia is a major cause of morbidity and mortality in the 'under-5s' and in Uganda accounts for 10–30% of childhood deaths. Antibiotic resistance is increasing.

OBJECTIVE: To describe the bacterial aetiology, antimicrobial sensitivity and outcome of severe pneumonia among children aged 2–59 months admitted to the Acute Care Unit, Mulago Hospital, Uganda.

METHODS: A total of 157 children aged 2–59 months with symptoms of severe pneumonia according to WHO guidelines were recruited over a 4-month period in 2005/2006. Blood and induced sputum were obtained for culture, and chest radiographs were undertaken. Children were clinically classified as having severe or very severe pneumonia and were followed up for a maximum of 7 days.

RESULTS: Bacteraemia was detected in 15.9% of patients with *Staphylococcus aureus* (36%) and *Streptococcus pneumoniae* (28%) were the organisms most commonly isolated. Bacteria were isolated from sputum in half of the children, the commonest organisms being *Streptococcus pneumoniae* (45.9%), *Haemophilus influenzae* (23.5%) and *Klebsiella* species (22.4%). *Staphylococcus aureus* had only 33.3% sensitivity to chloramphenicol and *H. influenzae* isolates were completely resistant. *S. pneumoniae* was sensitive to chloramphenicol in 87.4% of cases. The case fatality rate was 15.5%. Independent predictors of death were very severe pneumonia (OR 12.9, CI 2.5–65.8), hypoxaemia (SaO₂ <92%, OR 4.9, CI 1.2–19.5) and severe malnutrition (OR 16.5, CI 4.2–65.5).

CONCLUSION: *S. aureus*, *S. pneumoniae* and *H. influenzae* are common bacterial causes of severe pneumonia. Chloramphenicol, the current first-line antibiotic for treating severe pneumonia in Ugandan children, is useful in pneumonia caused by *S. pneumoniae* but other common bacteria show resistance. The presence of severe malnutrition, hypoxaemia and very severe pneumonia increase the risk of death and should be considered in case management protocols.

153. Delayed care seeking for fatal pneumonia in children aged under five years in Uganda: a case-series study

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ABSTRACT

OBJECTIVE: To review individual case histories of children who had died of pneumonia in rural Uganda and to investigate why these children did not survive.

METHODS: This case-series study was done in the Iganga/Mayuge demographic surveillance site, Uganda, where 67 000 people were visited once every 3 months for population-based data and vital events. Children aged 1–59 months from November 2005 to August 2007 were included. Verbal and social autopsies were done to determine likely cause of death and care-seeking actions.

FINDINGS: Cause of death was assigned for 164 children, 27% with pneumonia. Of the pneumonia deaths, half occurred in hospital and one-third at home. Median duration of pneumonia illness was 7 days, and median time taken to seek care outside the home was 2 days. Most first received drugs at home: 52% antimalarials and 27% antibiotics. Most were taken for care outside the home, 36% of whom first went to public hospitals. One-third of those reaching the district hospital were referred to the regional hospital, and 19% reportedly improved after hospital treatment. The median treatment cost for a child with fatal pneumonia was US\$ 5.8.

CONCLUSION: There was mistreatment with antimalarials, delays in seeking care and likely low quality of care for children with fatal pneumonia. To improve access to and quality of care, the feasibility and effect on mortality of training community health workers and drug vendors in pneumonia and malaria management with prepacked drugs should be tested.

154. Low validity of caretakers' reports on use of selected antimalarials and antibiotics in children with severe pneumonia at an urban hospital in Uganda

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ABSTRACT

Febrile children in low-income countries receive care from multiple sources, and caretakers' ability to report drug intake is crucial for appropriate prescription of drugs when reaching health facilities. This study describes and validates caretakers' reported use of sulfamethoxazole, chloroquine and

sulfadoxine in their children. We performed a cross-sectional study in 139 children diagnosed with severe pneumonia at hospital in Kampala, Uganda. Caretakers were interviewed regarding treatments given prior to arrival at the hospital. Reported drug intake was compared to drug levels in blood sampled on filter paper, analyzed by HPLC methods. Caretakers under-reported intake of the studied drugs. Positive and negative predictive values were 67 and 64% for sulfamethoxazole, 69 and 52% for chloroquine and 85 and 62% for sulfadoxine. Many caretakers were unaware of what drug had been given to the child, and more so if treated outside the home (risk ratio 2.6, 95% CI 1.2—5.6). We conclude that caretakers' reports of drug intake have limited validity. Health workers need to improve counseling of caretakers during drug dispensing, especially for antibiotics. The roles and names of different drugs should be emphasized during counseling, and existing information systems such as immunization cards should be considered for record-keeping of treatment given.

155. Local illness concepts—Implications for management of childhood pneumonia in eastern Uganda

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ABSTRACT

BACKGROUND: Pneumonia is one of the major killers of children under 5 years. Prompt and appropriate management is crucial; yet, the care a sick child receives depends on caretakers' perception of illness and action taken. Hence, understanding of local illness concepts on pneumonia and caretakers' response is crucial for interventions aimed at improved management.

OBJECTIVE: To elucidate local illness concepts involving childhood fever, cough and difficult/fast breathing and how these concepts' influence management of children with potential pneumonia. **Methods:** Key informant interviews with eight health workers and eight traditional healers and five focus group discussions, including presentation of a DVD showing children suffering from respiratory problems, with mothers of children under 5 years old in Iganga/Mayuge Demographic Surveillance Site (DSS) in eastern Uganda.

RESULTS: Many terminologies were used to refer to symptoms of pneumonia. Difficult/fast breathing was considered severe but was not presented among common childhood illnesses.

Mothers were likely to interpret any condition involving fever as malaria and had different preferred actions for difficult/fast breathing in their children. Although mothers mentioned using drugs at home for pneumonia related symptoms, they gave examples only of antipyretics. Health workers said mothers would use antimalarials and sometimes antibiotics to treat breathing problems.

CONCLUSIONS: There is a community knowledge gap on symptoms and biomedical treatment for pneumonia. To promote appropriate management of childhood fever, pneumonia and malaria as two separate illnesses should be highlighted, the role of antibiotics must be emphasized and local illness concepts should be addressed in behaviour change communication. © 2007 Elsevier B.V. All rights reserved.

Keywords: ARI; Malaria; Fever; Perceptions; Home management

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