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01: Health Systems/Health Economics

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Effect of Covid-19 pandemic on reproductive, maternal and child health services in Sub-Saharan Africa with a focus on Ghana

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Background research questions: Globally, the Covid-19 pandemic has had profound effects on Reproductive, Maternal and Child Health (RMCH) services. However, the extent of the impact on RMCH services in Sub-Saharan Africa (SSA) and Ghana is unknown. This study aims to determine the effect of the pandemic on RMCH services in SSA with a focus on Ghana guided by the following research questions;

1. What is the effect of Covid-19 pandemic on RMCH health services in SSA?
2. How has Covid-19 outbreak altered access to routine RMCH services in Ghana?
3. How has the outbreak of Covid-19 altered the utilization of routine RMCH services in Ghana?
4. What strategies have healthcare providers implemented to maintain quality standard care for RMCH services during the Covid-19 pandemic?

Methods: This study will employ a mixed-methods approach, combining quantitative and qualitative methods in a cross-sectional analytical study. The methods will include a systematic review and meta-analysis, secondary data analyses using the Ghana District Health Information Management System (DHIMS-2) and multiple rounds of the 2022 Ghana Demographic and Health Survey (DHS) data will be performed using the interrupted time series analyses. This will help assess differences between the pre-pandemic and pandemic phases. In-depth interviews with RMCH healthcare providers will yield qualitative data, which will be transcribed and analyzed with NVIVO version 12. The results from both quantitative and qualitative methods will be triangulated to validate emerging themes. Ethical clearance for the study will be sought from the Committee on Human Research, Publication and Ethics (KNUST), Kumasi and the Ghana Health Service Ethical Review Committee.

Expected findings: The study will contribute significantly to our understanding of the effect of the pandemic on access to and utilization of routine RMCH services in SSA and Ghana. It will provide insights into existing literature, quantify the time and extent of the pandemic's impact in Ghana, and assess its implications for healthcare access. The study will also shed light on measures taken by healthcare providers to ensure uninterrupted delivery of high-quality RMCH services.

Discussion: This study has the potential to inform policy decisions by enhancing our understanding of the pandemic's effect on RMCH services. It may inspire future policies for pandemic preparedness and refinement of healthcare delivery. This study represents the first rigorous analysis of the pandemic's effect on RMCH services in Ghana, providing vital data for evidence-based policy formulation. It will also highlight pandemic mitigation strategies employed by healthcare providers, which could further inform preparedness policies in Ghana.

Development of a multisectoral governance framework for health security: Lessons from the COVID-19 response strategy implementation in Sub-Saharan Africa with a focus on Ghana

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Research question: This research seeks to find answers to the question: Are there lessons from the COVID-19 Response Strategy implementation in Sub-Saharan Africa that could inform the development of a multisectoral governance framework for health security?

Methods: It will adopt a mixed-method approach (qualitative and quantitative) with the Mixed Methods Appraisal Tool (MMAT) Version 2018 as a guide. Data will be collected through stakeholder mapping using a culturally sensitive questionnaire, focus group discussion and key informant interviews will be done iteratively. A realist review, evidence synthesis framework, will be adopted to scope for concepts, theories and frameworks on health security using the Context, Generative Mechanisms and Outcomes (CMO) parameters to ascertain what works, for whom, within what context, how and why. A Strength, Weaknesses, Opportunities and Threats (SWOT) analysis on the National COVID-19 Response Strategy implementation will be conducted for critical learning. The realist review and the SWOT will then inform the development of a health security governance framework.

Expected outcomes: The review of the available conceptual frameworks and theories on health security governance will report on the following themes: What works, for whom, how and in what circumstances. A SWOT analysis on the National COVID-19 response strategy implementation based upon the review and the SWOT analysis develop a multisectoral governance framework for health security.

Discussion: The study aims to create a governance framework for health security preparedness and response in Ghana, drawing from lessons learned during the implementation of the COVID-19 response strategy. Health Security encompasses a range of interventions and systems designed to prevent, detect, minimise, and respond to infectious disease threats, conflicts, and acute public health events that pose risks to people's health across geographic regions and international boundaries. Despite the challenges faced during the COVID-19 pandemic, a 2021 Global Health Security Index report indicates that Ghana, like many other countries, is not adequately prepared for future epidemics and pandemics, ranking 104th out of 195 countries with an overall score of 34.3%. This highlights the need for improved coordination and communication between the International Health Regulations (IHR) National Focal Point (NFP) and other relevant ministries in Ghana, as evidenced by the 2019–2023 National Action Plan for Health Security, hence the need for this study.

The impact of COVID-19 on health service utilization in the management of non-communicable diseases in Ghana

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Introduction: COVID-19 has had devastating consequences on health systems globally and in sub-Saharan Africa (SSA). It led to a decrease in the provision of essential healthcare services and health service utilization (HSU) including the management of non-communicable diseases (NCDs). NCDs are responsible for about 71% of all deaths globally and account for 85% of deaths between 30–69 years in low- and middle-income countries (LMICs). The changes in HSU in Ghana as a result of the pandemic are unknown. This study therefore sets out to describe the changes in HSU during the pandemic and also determine the predictors and impact of COVID-19 on patients with selected NCDs.

Research question: What are the changes, predictors and impact of the COVID-19 pandemic on HSU in the management of NCDs in Ghana?


Methods: Multiple study designs will be employed to achieve the study objectives. First, a retrospective analysis of secondary data from the Ghana Health Service (GHS) District Health Information Management System (DHIMS-2), Lightwave Health Information System (LHIMS) database and hospital-based data before and during the COVID-19 pandemic will be performed. Second, a mixed method study will be conducted in selected health facilities in the Ashanti region, representing an epicentre of the pandemic in Ghana, and Northern region, representing a non-epicentre. This will involve (a) cross-sectional quantitative health facility data analyses, focusing on patients with NCDs and (b) qualitative in-depth interviews of NCD patients, healthcare providers and health service managers. The study will be conducted from November 2023 to June 2024. Ethical approval will be sought from the various Institutional Review Boards in the Northern and the Ashanti region.


Expected results: We expect to determine

1. the changes in outpatient and in-patient HSU before and during the COVID-19 pandemic in all patients compared with NCD patients in Ghana; and
2. determine the factors accounting for the changes in HSU and the impact of COVID-19 among patients with NCDs in an epicenter and non-epicenter in Ghana.

Discussion: We expect to discuss the changes, predictors and impact of HSU in an epicenter as compared to a non-epicentre in Ghana, and comparing our findings to others in SSA.

Analysis of the assembly of a virulence associated-salmonella Type III secretion system

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Introduction and research question: Virulence-associated type III secretion systems (T3SS) serve the injection of bacterial effector proteins into eukaryotic host cells. These effector proteins modulate host cell biology in order to promote colonization and infection. The core of T3SS is a cell envelope-spanning macromolecular machine called injectisome. It is 6 MDa complex consisting of more than 20 different proteins. Our general picture of the assembly of the injectisome reveals a conceptual problem at the early assembly of the needle filament. In this project, we want to clarify whether the secretin assembles onto the base before the onset of secretion of early substrates or whether needle adapter and filament secretion and assembly precedes assembly of the secretin complex. Also identify factors that regulate achievement of the correct path of assembly.

Methods: We utilize *in vivo* photocrosslinking, a technique that exploits the encoding of the artificial UV-inducible crosslinking amino acid p-benzoyl-phenylalanine to identify protein-protein interactions and to delineate assembly pathways. Also a highly sensitive luciferase-based analysis of type III secretion function.








Results: So far, the experiments that we have done, we got positive crosslinking from PrgJ-SpaP interaction. About PrgH-InvG interaction we didn't get the results expected, we only obtained unspecific bands around 109 kDa for positive and negative UV samples. Concerning NanoLuc luciferase analysis we found that later induction of *invG* can complement pre-existing T3SS.

Conclusion and outlook: For InvG-PrgH interaction we need deeper experiments, e.g., membrane fractionation to increase the sensitivity of the analysis. About, crosslinking of PrgJ-SpaP we have to repeat the experiment with a $\Delta invG$ strain to see if that impacts the PrgJ-SpaP interaction. From Secretion kinetics results we have to investigate if after adding the rhamnose, InvG assembles around the needle filament or it's a new T3SS.

02: Virology/Diagnostics

G-WAC23_02a (05)

Molecular and serological detection of corona-, henipa- and filoviruses in micromammals in Guinea

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The majority of infectious diseases in humans are zoonoses and originate from wildlife. Many factors such as the climate, land-use practices or social ecological aspects influence the risk of exposure and therefore, the cross-species spillover of pathogens with zoonotic potential. This also applies to corona-, henipa- and filoviruses, which have a broad host range, especially high zoonotic potential with severe disease in humans and thus, the potential to cause/ignite major epidemics up to pandemics. Despite the wide distribution and high risk for human health, there still is few data about potential hosts and reservoirs of corona-, henipa- and filoviruses in tropical settings. Micromammals (rodents and shrews) are not only known for carrying a high diversity of pathogens, they are also widely distributed in varied habitats, often in close contact to humans in urban habitats as well as to livestock or wildlife in rural or forest areas, overall with high risk for pathogens crossing species-barriers and human transmission. To prevent the spread and spillover of the above mentioned viruses and initiate a risk assessment, it is important to get a better knowledge of distribution and characteristics of these viruses and their transmission. Therefore, our aim is to evaluate if micromammals carry corona-, henipa-, and filoviruses, viruses with zoonotic potential, in tropical countries.

For that purpose, we will perform sampling and screening of micromammals in Guinea, as a hotspot of emerging infectious diseases in Sub-Saharan Africa. For representative results, tissue and blood samples will be collected from different regions of the country, including rural, urban and forest areas. Already existing molecular detection tools as well as newly established, serological methods will be used for analyses. To ensure the detection of a broad range of corona-, henipa- and filoviruses, PanCoronavirus-, PanParamyxovirus-, and PanFilovirus-PCR will be used for viral RNA detection. Positives will be further characterized through MinION sequencing using the SISPA approach.

The better knowledge about the role of micromammals as a reservoir for these viruses can support the risk assessment of transmission from reservoir species to humans and is therefore of great importance for the prevention and preparedness of potential outbreaks. Overall, during the project, the implementation of cutting-edge tools will serve in future surveillance studies to continue to shed light on the role of micromammals in the transmission cycle of these viruses.

Influence of helminth on SARS-CoV-2 infection outcome In Ghana

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Research question: This study seeks to answer the following questions:

1. What is the relationship between helminth infections and the severity of SARS-CoV-2 infections in Ghana?
2. What are the immunomodulatory effects of helminth infections on immune responses to SARS-CoV-2?
3. What is the impact of helminth infections on cytokine profiles in individuals with SARS-CoV-2 infection?
4. What are the potential associations between helminthiasis and reduced hyperinflammation in severe COVID-19 cases?

Method: Our study will focus on samples collected from three regions in Ghana; Ashanti, Western North, and Upper East. These are samples collected before COVID, during COVID and after COVID pandemic. Detailed demographic information from participants will be documented. RT-PCR will be employed for the diagnosis of COVID-19 cases. Blood plasma would be used to determine the seroprevalence of SARS-CoV-2 using EUROIMMUN Anti-SARS-CoV-2 ELISA Assay for detection of IgA and IgG antibodies and their antibody neutralizing potential using Procarta Plex Human SARS-CoV2 variants neutralizing antibody panel by ThermoFisher. Plasma cytokines levels will be quantified using the ProcartaPlex Human Cytokine storm panel 21-plex by ThermoFisher and read using the Luminex XMAP machine. Serological tests will be used to confirm *Ascaris*, *Strongyloides* and *Acanthocheilonea viteae* infections. Isolated PBMCs will be stimulated to assess T-cell activation. The data will be analyzed using SPSS statistical package and Graph pad prism to compare the cytokines and, antibodies and neutralization potential between mono and coinfecting groups.

Expected results: This study is expected to shed more light into the relationship between helminth infections and severity of SARS-CoV-2 infections, immunomodulatory effects of helminth infections on immune responses to SARS-CoV-2, impact of helminth infections on cytokine profiles in individuals with SARS-CoV-2 infection and the associations between helminthiasis and reduced hyperinflammation in COVID-19 cases.

Discussion: The study could yield diverse findings regarding the interplay between helminth infections and SARS-CoV-2. On one hand, it might suggest that individuals with concurrent helminth infections experience milder SARS-CoV-2 infections, potentially indicating a beneficial effect of helminthiasis on COVID-19 outcomes. This could imply that helminth-infected individuals exhibit a more enhanced or balanced immune response to SARS-CoV-2. Conversely, the study might reveal no clear association between helminth infections and the severity of SARS-CoV-2 infections. However, there is also the possibility that the research could indicate a detrimental effect, where helminth infections are associated with more severe SARS-CoV-2 infections.

Molecular epidemiology and immunological responses to SARS-CoV-2 and other respiratory viruses in selected urban and rural areas of Ghana

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Research question: This study seeks to answer the following questions:

1. What is the prevalence of SARS-CoV-2 and other respiratory viruses (RVs) in the selected urban and rural areas of Ghana?
2. What are the host immune responses to SARS-CoV-2 and other respiratory viruses among study participants?
3. What are the socio-demographic characteristics, and risk factors of SARS-CoV-2 and other respiratory viruses?
4. What are the various lineages of SARS-CoV-2 and other respiratory viruses among study participants?

Methods: We are sampling nasopharyngeal swabs and blood (serum) from participants above 10 years from two urban (Kumasi and Tamale) and three rural (Buoyem, Forikrom and Obuasi) areas in Ghana. Their socio-demography, clinical symptoms, and vaccination status will be taken with structured questionnaires. Viral RNA will be extracted and tested with a pan-Sarbecovirus real-time RT-PCR and samples with Ct=30 will be sequenced. Serum samples will be tested with ELISA for antibodies against spike (S) and nucleocapsid (N) proteins. The data will be analyzed using R programming language version 4.3.0.

Expected results: Various strains detected shall be reported. The mean concentration of IgG levels shall be analyzed using R to determine the difference in seroprevalence P1 and P2 for rural and urban areas respectively after the time-point-1 sampling and analysis. Time-point-2 blood sampling will be done after one year for participants who will test positive to determine their longevity/waning of antibodies to SARS-CoV-2.

Discussion: Information gathered will be essential for policymakers to prioritize health strategies and assess the effectiveness of public health measures implemented during the pandemic. Measures employed in Ghana to avert the effects of COVID-19 included non-pharmaceutical interventions and vaccination campaigns. The usefulness of these interventions has not been fully evaluated in the population. Understanding the prevailing levels of exposure and immunity in different sociodemographic contexts provides an important overview of the epidemiology of the virus in these populations. Findings shall provide useful baseline data that will inform further molecular-epidemiological and immunological studies on SARS-CoV-2 and other RVs in West-Africa.

03: Bacteriology/Parasitology

G-WAC23_03a (08)

Construction of bioresponsive membranotropic proteins to permeabilize the endosomal membrane

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The field of biomedicine is on a revolutionary shift towards non-viral delivery systems, promising innovative approaches to disease treatment that could transform healthcare systems worldwide. While these systems offer potential benefits, their efficacy remains a significant concern. One of the major roadblocks is the challenge of ensuring efficient endosomal escape before the payloads are degraded within the endosomal-lysosome degradative machinery. This research project focuses on the engineering of membranotropic proteins to enhance endosomal escape within non-viral delivery systems. The central premise is to engineer these proteins in a way that allows for fine-tuned regulation of their activity in response to the local microenvironment, such as variations in pH or redox potential. By incorporating these modified proteins into non-viral delivery systems, we aim to improve their endosomal escape capabilities, thereby enhancing the overall efficacy of these systems for therapeutic applications.

Enhanced delivery systems have the potential to revolutionize the accessibility, affordability and efficacy of disease treatments and thus, healthcare in general. By reducing the dosage required for treatments, the cost burden on healthcare systems could be alleviated, making advanced therapies more widely available. Moreover, the development of more efficient delivery methods could foster international collaborations and reduce the disparities in healthcare access and outcomes, thus contributing to the overall well-being of communities and nations. Research into non-viral delivery systems has the potential to not only propel the field of biomedicine forward, but also, to initiate dialogues and conversations that may influence the future of healthcare and medicine.

04: Epidemiology and Surveillance

G-WAC23_04a (09)

Epidemiology of SARS-CoV-2 infections in Ghana: A cross-sectional study from April to June 2022 in Kumasi

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Research question: This study sought to answer the following questions:


1. What is the prevalence and genomic characterization of SARS-CoV-2 in Kumasi, Ghana?
2. What is the disease exposure and COVID-19 vaccination rates from April to June, 2022 in Kumasi, Ghana?


Methods: We sampled individuals visiting the Kwadaso SDA hospital COVID-19 Testing Center, Kumasi and collected data on socio-demography, clinical symptoms, and vaccination status from 83 people. Nasopharyngeal swabs and sera were obtained. Viral RNA was extracted and tested with a pan-Sarbecovirus real-time RT-PCR. Samples with Ct=30 were sequenced. Serum samples were tested for antibodies against spike (S) and nucleocapsid (N) proteins by ELISA. Descriptive and inferential statistical analysis of data was then performed.


Results: Participants comprised patients (47%), hospital staff (20.5%) and international travelers (32.5%) who were aged 3–40 years and mostly males (67.5%). Common symptoms reported by patients included cough (33.7%), headache (30.1%), sore throat (21.7%), general weakness (13.3%), runny nose (12%) and fever or chills (14.5%). Chi-square analysis showed that coughing (χ^2 -value: 18.7, $p < 0.0001$) and having a sore throat ($p = 0.0010$) were significantly associated with a SARS-CoV-2 infection. Vaccination rate was 72.5% and RNA positivity was 42.2%. We could not demonstrate that vaccination prevented infection (OR=1.38, CI: 0.48–4.01, $p = 0.553$). Four BA.4 (22A) and one BA.5 (22B) Omicron variant sequences were obtained. Antibody positivity was 65% for S only and 35% for both S and N.

Discussion: The findings in this study suggest a high SARS-CoV-2 positivity and vaccination rate among people presenting with symptoms of respiratory illness in Kumasi between April and June of 2022. The high vaccination rate among participants, as compared to the reported national average of 57.3% may be partly attributed to the composition of study participants with a high proportion made up of healthcare workers and potential international travelers who are more likely to be vaccinated. The omicron variant appeared to be the main driver of infections with BA4 and BA5 subvariants co-circulating relatively early as compared to many countries in Europe. Our inability to demonstrate vaccine effectiveness against symptomatic infection reflects the immune escape properties of these subvariants. Protection against severe infection could not be assessed.

Epidemiological characterization of 2020–2022 COVID-19 deaths in Ghana

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Research question: Ghana confirmed its first cases of COVID-19 on March 12, 2020. As in other countries, a number of control measures were initiated, including contact tracing and enforcement of lockdowns. Despite the rollout of these measures, the country cumulatively had the 3rd highest number of COVID-19 related deaths in West Africa by February 2022. Understanding the distribution of mortality from COVID-19 is therefore necessary in order to contextualize and explain the country's COVID-19 burden and is necessary for informing the development and implementation of effective control measures. This study thus seeks to answer the following questions: What is the geographical distribution of COVID-19 deaths in Ghana? What is the age and sex distribution of these deaths? Are COVID-19 deaths associated with pre-existing medical conditions?


Methods: A cross sectional design was adopted for this study. Descriptive analyses of secondary data sourced from the National Disease Surveillance Department of the Ghana Health Service's Public Health Division were carried out. Data on COVID-19 cases and related deaths recorded in Ghana between 12 March 2020 and end February 2022 was used in the study. Demographic and clinical variables of cases were extracted from the data set, including age, sex, residence, pre-existing medical condition and date of death. STATA 16, QGIS and Microsoft Excel statistical packages were used for quantitative and spatial analyses. Univariate analysis was carried out for continuous and categorical variables and results presented in tables, graphs and choropleth maps to characterize the epidemiological features of the COVID-19 deaths.


Results: As at the end of February 2022, a total of 1,398 deaths were recorded and included in the analyses. COVID-19 deaths were observed to rise between June – October 2020 and November – February 2021. The Greater-Accra and Ashanti regions recorded the highest case and death counts. The Bono region recorded the highest deaths per 100,000 cases. The mean age of death was 58 years with the proportion of deaths higher in males. Persons aged 60 years and above experienced the most deaths. Eighty three percent of deaths had underlying medical conditions. Cardiovascular diseases formed the predominant category of underlying medical condition associated with COVID-19 deaths.

Discussion: Similar to findings from other countries, this study demonstrated that COVID-19 deaths in Ghana were highest amongst the elderly (>60 years) and persons with underlying medical conditions. As part of future pandemic or epidemic response measures, there is a need to target these groups with strategic case management approaches to save lives. The findings as well highlight the need to conduct in-depth analyses by sex, age, and important socioeconomic and clinical variables in order to inform the design and implementation of targeted public health interventions.

Excess mortality in countries with low-and lower-middle-income: A systematic review and meta-analysis


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Research question: This review sought to answer the following questions:


1. What is the estimated level of excess mortality during the COVID-19 pandemic in low-and lower-middle-income countries (LLMICs)?
2. What methods and data are used to estimate excess mortality in LLMICs?
3. What are the factors influencing excess mortality in LLMICs?


Methods: The protocol was registered in PROSPERO (ID: CRD42022378267). We searched PubMed, Embase, Web of Science, Cochrane Library, Google Scholar, and Scopus for studies conducted in LLMICs on excess mortality. These included studies with at least a one-year non-COVID-19 period as the comparator in estimating excess mortality and with publication dates from 2019 to date. The meta-analysis included studies with extractable data on excess mortality estimates, methods, population size, and observed and expected deaths. We used the Mantel-Haenszel method to estimate the pooled risk ratio of excess mortality with 95% confidence intervals.


Results: The review included 25 studies, of which 7 were included in the meta-analysis. Of 1,405,128,717 individuals, 2,161,846 deaths were expected, and 3,633,661 deaths were reported. The pooled excess mortality was 104.7 deaths per 100,000 population per pandemic period. The risk of excess mortality was 1.68 (95% CI: 1.67, 1.68 p<0.001). Data sources included civil registration systems, obituary notifications, surveys, public cemeteries, funeral counts, burial site imaging, and demographic surveillance systems. Techniques used to estimate expected deaths during the pandemic were mainly statistical forecast modelling and geospatial analysis. Of the 21 studies, only one found higher excess mortality in urban settings.


Discussion: These findings contribute to a better understanding of the effect of the COVID-19 pandemic on excess mortality in LLMICs. Excess mortality in LLMICs during the pandemic was substantial; higher than direct COVID-19 mortality. Even though the availability of reliable data was a problem in many countries, the identified methods may inform future studies to provide more reliable estimates of excess mortality in LLMICs. Further studies are needed to identify the drivers of excess mortality in LLMICs, and methods identified in this review may inform future analyses.

Assessment of knowledge, attitude and practices on the influence of land-use on threats of zoonoses: Case of Katavi – Rukwa ecosystem, Tanzania

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Research questions: What are the KAP on zoonoses in the study area? What are the most commonly occurring zoonoses in the study area? And how land use influences the occurrence of zoonoses?

Methods: A cross-sectional study was conducted from May to July, 2022 to assess the knowledge levels, attitudes, and practices of various actors regarding zoonoses and what are the land-use in study area. Data were collected through household surveys, observation, interviews, medical reports and literature review, involving a total of 299 respondents. Descriptive statistics and Pearson Chi-square test were performed to evaluate the association of demographic characteristics and Knowledge, Attitude, and practices of respondents regarding zoonoses.

Results: Most respondents (28.1%) were between 26–35 years old and (52.5%, 47.5%) were males and females respectively. (74%) of the respondents had no knowledge on zoonotic diseases transmission. Sleeping sickness was the highest disease reported in the study area (4.32%), followed by Brucellosis (3.32%) and rabies. (90%) of the respondents rely on agriculture, a situation that influences land-use changes and attracts human-wildlife interactions. Regarding practices, (4.32%) of livestock owners are not treating their animals according to the veterinary procedure and (24.92%) consume the carcasses when animal died. Association test between demographic characteristics and (KAP) regarding zoonosis have indicated the association between gender and knowledge ($\chi^2=12.120$, $df=1$, $p<0.001^*$). Education levels had significant association with knowledge ($\chi^2=8.282$, $df=3$, $p=0.041^*$), but not with attitude and practice, ($p=0.396$ and $p=0.127$, respectively).

Discussion: Findings have highlighted most of the respondents are involved in activities that expose them to the pathogens of the zoonotic disease due to resource sharing with wild animals. Expanding community-based livestock health education and promotion activities plays a key role in improving the awareness towards zoonoses. The study recommends designing and implementing the effective One Health interventions to mitigate zoonotic disease risks and promote sustainable land-use.

Preliminary estimates of excess deaths during the COVID-19 pandemic in Ghana

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Research question: Excess mortality is aimed at capturing the true impact of the pandemic beyond only confirmed and reported COVID-19 deaths. This study sought to address the question, what was the level of excess mortality during the COVID-19 pandemic in Ghana?

Methods: Ethical clearance for this study was obtained from the Committee on Human Research and Publication Ethics, KNUST (CHRPE/AP/855/23). The study design involved a comparison of two distinct periods: pre-COVID-19 pandemic (2015–2019) and during the COVID-19 pandemic (2020–2021). The primary data source utilized was the District Health Information Management System (DHIMS). To estimate expected deaths, a moving average modelling technique was employed, with a 5-year baseline.


Results: Total recorded deaths in 2020 were 38,429 and in 2021, 43,569. The expected numbers of deaths for these years were: 34,170 in 2020 and 34,233 in 2021. Excess deaths were estimated to be 4,259 in 2020 and 9,337 in 2021. Excess deaths represented an 11% increase in deaths in 2020 and a 21% increase in 2021. Furthermore, the excess mortality per 100,000 population was 13.8 in 2020 and increased to 30.3 in 2021. In 2020, excess deaths were observed in eleven out of sixteen regions, while in 2021, 12 regions recorded excess deaths.


Discussion: Overall, the observed deaths were higher than the expected deaths during the COVID-19 pandemic in Ghana. These are preliminary results and only include deaths recorded in health facilities. The findings of this study help to better understand the effect of the COVID-19 pandemic on mortality, inform the design and implementation of interventions and measurement of their impacts during outbreaks, show regional variations, and help to understand the epicentres of the COVID-19 pandemic. Further studies are needed to identify the drivers of excess mortality in Ghana using other data sources.


05: Community Engagement/Social Sciences


G-WAC23_05a (14)


Multi-level assessment of testing and influencing factors as a doorway to the implementation of Test, Treat and Track (T3) for malaria control in Ghana

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Research question: Malaria is a debilitating vector-borne disease accounting for 619,000 deaths and 247 million cases across 84 endemic countries according to the WHO. Ghana is implementing the test, treat and track (T3) strategy for malaria control. Testing as part of the T3 strategy is a function of the health seeking behaviours of the population and other health system factors including the role of prescribers in requesting tests for suspected cases and moderating factors related to the reliability of diagnostic tools used. Quantification of the effectiveness of the testing component of the overall T3 strategy will provide pointers to the status of universal coverage of malaria diagnosis, and surveillance. This study will assess the effectiveness and compliance of the health system actors to the testing component of the T3 strategy in Ghana.

Method: The study will employ a multi-stage approach and will target different populations groups in the Central Region of Ghana. A cross sectional study (stage one) of targeted locals zoned around selected health facilities providing testing for malaria will assess the health seeking behaviour, community dynamics and socio-cultural influencers related to malaria management among the community. A further cross-sectional study will be conducted to assess knowledge, attitudes and practices of prescribers in the health facilities identified in stage one, towards requesting testing for suspected malaria cases. Thirdly, an exploratory sequential study among laboratorians will investigate the accuracy of malaria tests conducted and factors associated with the accuracy observed. Population level misdiagnosis rates will be estimated.

Expected results: Community dimensions of the T3 strategy will be explored to identify opportunities for improving coverage of the T3 strategy implementation for malaria control. The role prescribers and their adherence to the T3 strategy will be quantified as a quality measure of the implementation of the T3 strategy for malaria control. Missed cases will be quantified, highlighting gaps in providing quality diagnostic services. Comparisons of outcomes of diagnostic techniques will inform quality assurance measures for the success of the T3 strategy for malaria control in Ghana.

Community engagement for pandemic preparedness and response in Sub-Saharan Africa: A scoping review

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Background: Community participation in epidemic and pandemic preparedness and response activities is key for the successful implementation of infection control activities. However, the strategies and approaches used by health authorities and service providers to engage communities are not well documented. This scoping review aimed to summarize strategies for community engagement for epidemic and pandemic preparedness and response in Sub-Saharan Africa.

Methods: The PRISMA Extension for Scoping Reviews (PRISMA-ScR) and the methodological framework for scoping review from Arksey and O'Malley (2005) were used to guide the review. Peer-reviewed, primary research was retrieved from databases including EMBASE, EBSCO-host, PubMed, Global Health, CINAHL, Google Scholar and Web of Science. Grey literature was retrieved from websites of international organisations, and of Ministries of Health in African countries. A total of 95 articles were included in the review, and data was extracted and analyzed using a thematic analysis approach.

Results: Community engagement strategies varied widely across different contexts. Four broad categories of approaches were identified:

1. community mobilization,
2. community-based surveillance,
3. social and behaviour change communication, and
4. community participation in decision-making.

The review also identified key enablers and barriers to community engagement, including factors such as trust, cultural norms, and resource availability.


Conclusion: Effective community engagement for epidemic and pandemic preparedness and response requires a tailored approach that is responsive to the local context, and that addresses the specific needs and concerns of different communities. The review provides a comprehensive overview of the current state of knowledge on strategies for community engagement in sub-Saharan Africa and highlights the need for further research and evaluation of community engagement approaches in this context.


Main messages:

- Community engagement plays a critical role in effective epidemics and pandemic preparedness and response.
- The appropriate community engagement strategy to employ is context-dependent and varies across geographies and cultures.

G-WAC23_05c (16)

Human-wildlife interaction results in community forest conservation: Insights from Kedjom Keku, North West Region of Cameroon

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Research questions: Humanity have interacted with wildlife time immemorial for many purposes leading to different outcomes around the globe. In Sub Saharan African countries like Cameroon, the Kedjom Keku community have been interacting with several wildlife species in the Abonphen community forest for some sociocultural practices but, the scientific debate on human-wildlife interaction has remained on human wildlife conflicts and disease spill over, limiting the scope of such interconnections. This study aims to answer questions such as:

1. Which wildlife species have indigenous people of Kedjom Keku interacted with for what sociocultural purpose(s)?
2. Does human-wildlife interaction spur conservation action and if so, what are the contributions of the local people to the conservation of wildlife and the Abongphen community forest?
3. What are the challenges to indigenous contribution and conservation of the Abongphen community forest?

Method: Data was procured through a purposive survey of 50 households, 5 key informant and 2 expert interviews to understand the wildlife species indigenous people interact with for sociocultural practices, motivations, contributions and challenges to the conservation of wildlife and the Abonphen community forest. Data analysis and visualisation was done with the help of Microsoft Excel 2013 and qualitative content analysis as well as narratives.

Results: We found that the Kedjom Keku community link their existence to the Abongphen forest and interactions with wildlife are leveraged for some sociocultural practices like the use of Buffalo horns by notables to drink palm wine. This in part motivates the local people to contribute to forest conservation mainly through tree planting (60%) and participation in forest management activities (20%). Through interviews, we also found that the ongoing socio-political armed conflict greatly challenges conservation actions.

Discussion: Though the Kedjom Keku community interacted with wildlife, local actions towards the conservation of the Abongphen community forest were readily apparent but, not those towards wildlife. This could be explain by the fact that the community attaches greater sociocultural values to the forest such as linking their existence to that of the forest. This information is useful for targeted interventions addressing human wildlife interaction and forest conservation. However, whether human-wildlife interaction for sociocultural purposes is more or less susceptible to pathogen spill over does not lie in the ambits of the discussion in this paper but, we belief that a proper consideration of the diverse outcomes of human wildlife interactions is important for an improved and inclusive management approach especially regarding pathogen spill over.

05d (17)

Assessing the impacts of elephants and human interactions in Tsavo conservation area between Kamung'i and Mangelete communities

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The overlap in wildlife requirements with those of human populations creates costs to both humans and wildlife and hence human-wildlife conflict (HWC). In Kenya, HWC is escalating and has become a significant issue in the conservation and land use management. However, elephants are the most frequently implicated HWC this two communities due to high human population with limited income opportunities. This interaction and the social response of humans to crop and livestock depredation, labour and opportunity costs of crop and livestock defense and loss of wildlife species through retaliatory attacks is critically threatening wildlife conservation. This study will try to answer: How do human activities and land use practices in the Tsavo Conservation Area impact the distribution and behavior of elephants? What are the specific health risks and benefits associated with the presence of elephants in the Mangelete and Kamung'i communities within the Tsavo Conservation Area? How do cultural beliefs, traditional knowledge, and community perceptions influence the coexistence between elephants and humans in this region? What are the implications of human-elephant interactions on the mental and emotional well-being of community members in the study area? How can the findings from this research inform conservation strategies, human-wildlife conflict mitigation, and public health initiatives in the Tsavo Conservation Area? This study employed quantitative and qualitative research methods to gather information on people's interactions with wildlife and their health outcomes. The results will increase awareness and understanding of the vital role of biodiversity in supporting human health, gain insights into the nature and consequences of conflict on the wellbeing of communities living with elephants. The results show that elephants still use the communal lands in Tsavo conservation area. However, there was no evidence of a further decline in the elephant range. Instead, this study points to a shift in elephant range against a background of increasing human settlement, land sub-division and agricultural expansion. The wellbeing of the two communities comprised eight indicators. Human-elephant conflict negatively affected peoples 'wellbeing', with transfer of Anthrax to humans through their livestock. Attitudes towards elephants and its conservation in TCA were influenced by the location of human residence relative elephant refuge, diversity of income sources, and age and gender. Human-elephant interaction in TCA is still elusive and challenging, but opportunities exist to develop simple and dynamic mitigation tools. The findings of this study have important implications for the future of elephant conservation in the face of competing human needs, both in Tsavo conservation area and elsewhere in Africa.

06: Digital Health

G-WAC23_06a (18)

Baseline study of the ReachUHC project to assess acceptability of mobile-phone-based interventions to improve health insurance coverage in Ghana

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Background: Universal health coverage aims to protect households from catastrophic health expenditures. However, recent studies found forgetfulness and being too busy to contribute to low health insurance renewal rates in Ghana. To reduce gaps in coverage, mobile-based reminder and auto-renewal options will be introduced in Kumasi, with Accra as control site. In the baseline study, we analyze NHIS routine data to investigate the demographics of active members. We also conduct a baseline population survey in Kumasi and Accra, which we use to ascertain the acceptability and inform the design of our proposed intervention.

Methods: Using a full sample of NHIS transaction records for the years 2018–2021, we estimate descriptive statistics for our outcomes of interest. The population survey employs a cross-sectional design with two-stage cluster sampling of the treatment and control populations. We survey 811 individuals (379 in Kumasi and 432 in Accra) in 564 households (284 in Kumasi and 280 in Accra) to collect baseline data on household and sociodemographic characteristics, health insurance status, intervention acceptability, and user preferences.

Results: NHIS routine data shows a stark reduction in coverage among men when they turn 18 years old and lose exemption status, while coverage among women of that age remains high. In the survey population, adult men were 3 times more likely to report never having registered for insurance. Almost 50% of nonrenewers reported that they forgot or were unaware of their upcoming expiry date. 93% of all individuals endorsed mobile-phone based reminders, and 69% supported an auto-renewal option. Financial barriers were stated only by a minority of respondents: 17% reported an inability to pay for renewal, and 10% reported an unwillingness to pay.

Conclusions: Forgetfulness and unwillingness to insure were the two largest barriers to renewal. Renewal reminders and automatic renewals may thus be highly acceptable and cost-effective interventions to increase population coverage among those willing to insure themselves.

Policy implications:

1. Affordability may not be the major barrier to insurance uptake in Ghana that is it often thought to be.
2. Nudging approaches such as reminders or auto renewal systems may be effective interventions to improve coverage rates.

Mhealth tools for community-based infectious disease surveillance in Africa: A scoping review

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Research question: What has been written about the use of mhealth tools for infectious disease surveillance among community-based surveillance volunteers in Africa?

Methods: The scoping review protocol was registered in OSF registries (<https://osf.io/w7mty>). We followed a mixed-methods approach in line with the framework of Arksey and O'Malley amended by Levac et al. and the Joanna Briggs Institute. We searched PubMed, Scopus, Web of Science, CINAHL, Google Scholar, Google and websites of relevant organizations for peer-reviewed and grey literature. Search terms included a range of synonyms for the three concepts of (1) mhealth, (2) CHW and (3) Africa. Reports were included if they reported on mHealth tools used by CHW for infectious disease surveillance in Africa.


Results: We identified 2,496 titles during our search but only 26 met our inclusion criteria. Nineteen mhealth tools were identified with the greater number, (four) implemented in Kenya and Rwanda each, followed by Uganda (three). Studies focused on one or more diseases or symptoms such as: Acute Flaccid Paralysis, Lymphatic Filariasis, COVID-19, meningitis, measles, and brucellosis. Interventions were mostly at the feasibility testing phase and relied on CHW sending text messages, photographs or interactive voice responses via the mhealth tool. Users' perspective of mhealth tools included: improved surveillance, better linkage with the community and greater efficiency.


Discussion: We found a moderate number of mhealth tools used by CHWs for infectious disease surveillance in Africa, with the highest number implemented in East Africa. Tools mostly focused on epidemic-prone and neglected tropical diseases and linked CHW with their supervisors and communities. Though most tools were at the early stage of implementation, users gave a good perspective of the tools. Results indicate that mhealth holds the potential for strengthening community-based surveillance in Africa.


The potential of mobile technologies to promote insurance renewal in Ghana: A qualitative study

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Introduction: The mobile phone renewal system (MRS) has increased renewals in the National Health Insurance Scheme (NHIS) in Ghana. However, population coverage with active membership remains low, especially among informal workers. We explored how mobile phone add-ons can further promote insurance renewal in the NHIS through the decision-maker's and informal workers' perspectives.


Methods: Qualitative data were collected from 13 decision-makers involved in the development and implementation of the MRS and 17 focus group discussions with 96 informal workers using semi-structured in-depth interview guides in Accra and Kumasi between March and August 2022. Thematic analysis was used to identify recurring themes and categories.


Results: Mobile phone technology was perceived as beneficial, with further potential to facilitate NHIS coverage. Participants proposed several functionalities (add-on tools) that digital technologies could offer to make NHIS renewal more accessible. Tool-related, institutional, and individual factors must be considered when implementing digital add-on tools. Besides improving technological and data protection infrastructure, implementation efforts must be responsive to National Health Insurance Authority (NHIA) employees and potential users.


Conclusion: Different mobile technologies can potentially contribute to increasing NHIS coverage in Ghana. Implementation should address digital literacy and build trust in the use of mobile technology.

Digital technology-based surveillance systems for pandemic response and control: Assessment of SORMAS towards scale-up and integration into existing health systems

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Research question: Digital technology has transformed societies worldwide over the past three decades. Digital health interventions especially have been shown to greatly improve the provision of healthcare globally. Notwithstanding their benefits, numerous digital health interventions are not efficiently implemented and or spread slowly thus affecting their usefulness. Surveillance Outbreak Response Management and Analysis System (SORMAS) is a digital health tool that allows for comprehensive disease surveillance and outbreak management on one platform. The tool has been used for COVID-19 management in Ghana. This study aims to assess the maturity of SORMAS in Ghana, factors that facilitated or inhibited its adoption and investigate factors that will ensure its sustainable implementation and integration into existing health systems. The study will also assess the impact SORMAS has had on surveillance and outbreak response in Ghana since its adoption.







Methodology: This study will use a qualitative approach. Study participants will be SORMAS stakeholders and users at all healthcare levels including field epidemiologists, surveillance officers, health information officers and laboratory personnel. Qualitative data will be collected through in-depth interviews to answer the research questions. Data will be transcribed and analyzed using Atlas.ti. The Global Good Maturity Model (GGMM) will be used to assess tool maturity and the CDC framework for evaluating surveillance systems will be used to assess the impact of the tool. Factors that affected adoption will be grouped into predisposing factors, needs and enabling resources. Data will be analysed according to the mHealth Assessment and Planning for Scale (MAPS) toolkit to determine the level of implementation of the tool in Ghana and identify measures to ensure sustainability. Ethical approval for the research will be sought from the Committee of Human Research and Publication Ethics (CHRPE), KNUST, Kumasi and the Ghana Health Service (GHS), Ghana. Informed consent will be obtained from each participant before enrollment.

Expected results: The study will identify the weaknesses of SORMAS in Ghana that need improvement and provide an overview of the impact of SORMAS on disease surveillance and outbreak response in Ghana. The study will also provide lessons for other countries on facilitators of and barriers to the adoption of SORMAS and discover practical factors that will facilitate its sustainable adoption and implementation into existing health systems.

07: Zoonosis

G-WAC23_07a (22)

Bats and their viruses in the city scape

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Urbanization is a complex phenomenon that involves various changes, both environmental, demographic, and socio-economic, with the aim of benefiting people. This phenomenon usually has a significant impact on the environment through the reduction of green areas (vegetation cover), which generally affects the abundance, species richness, behavior, and physiological condition of bats. In general, there is evidence that urbanization has a variety impact on bats; however, bats are one of the most diverse groups to persist in cities. Our research question is how urbanization affects the composition and diversity of viruses in the synanthropic bat *A. jamaicensis*. The study was carried out in the city of Mérida, Yucatán, México (20° 58' N 89° 37' W/20.97, -89.62). Four transects oriented in the four cardinal directions were sampled to collect bats using mist nets. Bats were inspected to collect ectoparasites and tissues. The city of Mérida, Yucatán shows a radial growth pattern; in addition, a marked gradient is observed on the different variables analyzed. We observed effects on the ecology of *Artibeus jamaicensis* populations, sex proportions, body condition, prevalence of ectoparasites. Samples are currently being processed for Next-Generation Sequencing (NGS) analysis to characterize the virus diversity and their change along the urbanization gradient. Increase the connectivity among green spaces to reduce the hyper-concentration of bats in urban landscapes, which will reduce density dependent virus transmission. Implement measures to improve social communication and awareness about the benefits of wildlife presence in the cities.

The status of filoviruses (Marburg) in bats and domestic animals in Ghana

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Project description: Marburg virus (MARV) is a hemorrhagic fever virus that causes disease in both humans and nonhuman primates. The virus belongs to the family Filoviridae which includes the Ebola virus known for epidemics with high mortality in Africa. Previous studies suggest that fruit bats are reservoir hosts for these filoviruses with pigs and other domestic animals serving as amplifying hosts. However, this is not definitively known. There was an index case of Marburg in Ghana in 2022 which resulted in two deaths. Domesticated animals are widely used as food sources, companion animals, or as a workforce in these areas where Marburg has occurred in Ghana and should be investigated for their potential role in virus transmission. This study investigates the presence of Marburg virus in bats, livestock, and pets in selected zones in Ghana.

Bat and livestock tissues and sera will be collected from selected study sites in Ghana and stored in Accra Veterinary Laboratory until samples are tested. Structured questionnaires will be administered to farmers and data will be collected using Kobo Collect Toolbox. Serological and reverse transcription PCR techniques will be used for sample testing and further analysis will include high-throughput next generation sequencing.

Expected results: Seroprevalence and risk factors of Marburg in bats and livestock animals will be determined. The possible sequence of events to predict linkage for spillover will be understood. The interaction between wildlife, companion animals and humans in the affected communities will be better understood.

Lesson learned: The findings from this study will be useful for: Informing the design of MARV surveillance in Ghana as currently does not exist in any policy document. Implementing strategies for the control of filoviruses in Ghana. Implementing evidence-based targeted public health messaging to at-risk communities to reduce the risk of spillovers. We have learnt that we can develop a diagnostic tool in our laboratories for the purpose of research and diagnosis for MARV in Ghana.

Evaluation of COVID-19 and Brucellosis infections in dogs, their owners and contact veterinarians in the Ashanti and Greater Accra Regions of Ghana

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Research questions: Are pets, their owners and contact veterinarians exposed to COVID-19 and Brucellosis in the Ashanti and Greater Accra Regions of Ghana? What are the risk factors of COVID-19 and Brucellosis in the study population? Is there co-infection with multiple pathogen (COVID-19 and Brucellosis)? Are there possible zoonotic linkages between humans and animals?

Method: Blood samples and nasopharyngeal swabs will be taken from dogs (246) and owners (385) for serological and molecular analysis. Structured questionnaire (385) will be used to gather information on risk factors of COVID-19 and brucellosis in dogs and their owners. To evaluate the feasibility of the proposed study, a cross-sectional hospital-based pilot study was conducted on fifty dogs using Rapid Diagnostic Test Kit (RDTs) for the detection of SARS-CoV-2 antigen and antibodies while 20 dogs were tested for *Brucella canis* antibodies.

Results: Eight out of the 50 samples (16%) tested positive for the COVID-19 antibody test while one out of the 50 samples (2%) tested positive for the COVID-19 antigen test. One out of the 20 samples (5%) tested positive for brucellosis.

Discussion: The 5% seroprevalence of *Brucella canis* in dogs found in the study is higher than what was found by Hamdy et al. in South Africa but lower than what was established by Anyaoha et al., despite disparities in the sample sizes. The 2% positivity of COVID-19 detected as a result of antigen testing confirms active infection with the SARS-CoV-2 which is among the first of such reports in dogs using this RDTs.

The finding that age significantly influenced the seroprevalence of SARS-CoV-2 in dogs could be due to the high-straying behavior of dogs to mingle and find mating partners.

Conclusions: The pilot study showed that there is need to further evaluate the status of the diseases in dogs, their owners and contact Veterinarians hence we recommend a larger scale of evaluation as proposed.

From local to global – white-toothed shrews as reservoirs for potentially zoonotic pathogens

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Small size, synanthropic behaviour and ubiquity are characteristics of small mammals that may facilitate the occurrence of spillover events. While rodents are known carriers of multiple pathogens with pandemic potential, less is known about insectivores, such as shrews.

We have investigated the pathogen presence in white-toothed shrews (Crocidae) from Central Europe. Almost 400 individuals of bicolored white-toothed shrews (*Crocicidura leucodon*), lesser white-toothed shrews (*Crocicidura suaveolens*) and greater white-toothed shrews (*Crocicidura russula*) were tested for the presence of *Leptospira* spp., *Coxiella burnetii*, *Brucella* spp. and arthropod-borne pathogens (*Anaplasma* spp., *Babesia* spp., *Neoehrlichia mikurensis*, *Bartonella* spp.) with different PCR methods. *Leptospira* spp. were found with a prevalence of 12% with *L. kirschneri* (sequence type 100) in *C. russula*. Two *C. russula* tested positive for *N. mikurensis*, which is the first description in shrews. *Crocicidura leucodon* is the known reservoir for Borna Disease Virus 1 (BoDV-1, species *Orthobornavirus bornaense*) causing lethal encephalitis in humans and domestic animals. We took the first ever detected geographic cluster (human n=2; death 2019 and 2022) in a municipality in Bavaria, Germany, as an opportunity for an interdisciplinary One Health investigation. We assessed the local small mammal community to narrow down possible infection sites and conducted a survey to evaluate potential shrew-human interfaces. Of all analysed small mammals, 9/21 *Crocicidura leucodon* tested positive for BoDV-1 RNA. The results were presented to the public during a community meeting.

Overall, our study is the first to shed light on the virosphere of different crocidurine shrew species from Central Europe by implementing a metagenomic next-generation sequencing approach. RNA of individual organ pools from *C. leucodon*, *C. suaveolens*, *C. russula* and *Suncus etruscus* (Etruscan shrew), the latter from a husbandry, were extracted, further processed, and finally sequenced. Subsequently, RT-qPCRs were designed for newly detected viral sequences. Whole-genomes were obtained for several novel viruses of the families *Nairoviridae*, *Paramyxoviridae* and *Hepeviridae*. Some of them formed phylogenetic clusters closely related to highly relevant viruses such as Crimean-Congo haemorrhagic fever virus and henipaviruses. Our study has started as a regional investigation in Germany on a specific virus with enormous public interest, addressing important questions for the assessment of human-wildlife contacts and the establishment of preventive measures, and enabled us to identify novel viruses in white-toothed shrews with phylogenetic relationships to globally important diseases. Further investigations are needed to characterize these novel viruses and to assess their zoonotic potential, and to evaluate its significance in a global context.

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