

COVID-19 AND AFRICA'S VOLATILE CHANGING EPIDEMICS LANDSCAPE:

LESSONS FROM THE SACIDS FOUNDATION FOR ONE HEALTH



SACIDS Foundation for One Health
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The emergence of several infectious diseases in the last few decades has caused epidemics of regional and global concerns. Scenarios ranging from the changing climate, emergence of new pathogens and re-emergence of others, increased ease, volume and speed of cross-border population movements, pose a substantial threat to global health security. In such instances, Africa bears the highest burden of infectious diseases of humans and animals in the world, which include the new disease, COVID-19, on top of other epidemics such as Ebola and widespread antimicrobial resistance (AMR).

With the declaration of COVID-19 as a pandemic by the World Health Organization (WHO) on March 11, 2020, the world over, countries' health systems have been weakened, exposing high levels of vulnerability due to the slow allocation of funds and resources to tackle the pandemic. In Africa, the disruption of already-strained healthcare services is causing considerable pressure to national governments that are striving towards achieving socio-economic development. Having anticipated that the virus would quickly spread to Africa, the [Africa Centres for Disease Control and Prevention](#) (Africa CDC) partnered with the World Health Organization (WHO), the US Centers for Disease Control and Prevention (US CDC), the National Public Health Institutes (NPHIs) or equivalent government agencies, and the Ministries of Health to prepare African Union Member States to respond to the outbreak in their countries.

With a clear response strategy to capacitate the Member States to quickly detect and mitigate the effects of COVID-19 in Africa, and, if widespread transmission occurs, prevent severe illness and death, the African Union and Africa CDC launched the initiative [Partnership to Accelerate COVID-19 Testing](#) (PACT), which focuses on tracking, testing and tracing. Since the beginning of the outbreak, Africa CDC has trained hundreds of

experts from AU Member States in different aspects of COVID-19 prevention and control. These include laboratory diagnosis, enhanced surveillance and point of entry screening, infection prevention and control, risk communication, and case management. Such efforts are receiving recognition and support from partners that want to fund COVID-19 preparedness and response activities in Africa.

Strengthening SACIDS and regional COVID-19 emergency preparedness in eastern and southern Africa

In Africa, progressive capacity development of expertise for infectious epidemic diseases as witnessed by the [SACIDS Foundation for One Health](#) (SACIDS) resulted in being alerted to the risk of the global spread of COVID-19 even to Africa as early as January/February 2020. As soon as initial cases were recorded on the continent in February 2020, SACIDS sought financial support to enable member institutions to provide expertise to national preparedness and early response. And as a result, SACIDS together with the Africa CDC, and the [East African Integrated Disease Surveillance Network](#) (EAIDSNet), were funded by the [Skoll Foundation](#) for the '[Strengthening SACIDS and regional COVID-19 emergency preparedness in eastern and southern Africa](#)'. This enabled SACIDS institutions in the diagnosis and subtyping, enhanced surveillance and risk communication in the Democratic Republic of the Congo (DRC), Mozambique, Tanzania and Zambia.

Under this partnership and implementing the [African Continental Strategic Plan for COVID-19 Pandemic](#), Africa CDC sets the continental framework, harmonisation with global bodies and provision of guidance; EAIDSNet, through the Uganda Virus Research Institute (UVRI), coordinates health officials to harmonise their activities in the East African Community (EAC)

member countries; and SACIDS provides and, jointly with EAIDSNet, develops expertise for its institutions to inject expertise, technologies and competence into the national systems in the SACIDS and EAIDSNet member countries or other parts of Africa as may be appropriate to support the framework of the Africa CDC.

Democratic Republic of the Congo

The Democratic Republic of the Congo (DRC) faces a most unprecedented challenge of dealing, simultaneously, with two epidemics of international concern – the Ebola virus disease (EVD) and COVID-19. The first coronavirus case in the country was confirmed on March 10, 2020, in the country's capital city of Kinshasa, and soon after there was another independently introduced focus in South Kivu and North Kivu Provinces, Northeast of the country. The first case of South Kivu occurred on March 29 and in North Kivu on March 30.

By June 17, 2020 a total number of 5,282 coronavirus cases were confirmed, including 122 deaths, from 11 provinces, with Kinshasa being the epicentre with 4,772 cases (90%). The country responded by quarantining Kinshasa City, confining the Gombe community, closing national borders, and effecting social distancing measures. And shortly before declaring the end of the 10th epidemic of the EVD, two new Ebola cases were identified in the area of Beni in North Kivu province. However, the new introduction of the Ebola virus in the human population of the Equateur province on May 31, 2020, confirmed the 11th EVD epidemic in the country.

In response to COVID-19, the country's National Institute for Biomedical Research (INRB) – in its role in the surveillance and interdisciplinary-One Health research – organised a capacity building workshop for the COVID-19 response teams in three health zones of the Provincial Health Division (PHD) of Kongo Central i.e Kimpese, Mbanza Ngungu and Kisantu (Fig. 1). Specifically, the project aimed to update participants' knowledge on severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and COVID-19; present the national response plan against COVID-19 and the WHO guidelines related to the different pillars of the response; assess the hospital triage circuits and the facilities planned for the management of COVID-19 patients; train laboratory technicians in the collection, packaging and transport of specimens and the use of rapid diagnostic tests and the GenExpert®; and provide diagnostic specimen collection

kits (blood sampling, oropharyngeal and nasopharyngeal swabs) and personal protective equipment (PPE).

The training enabled participants to anticipate in crisis in rural areas while the province was still in the ascending phase of the epidemic. The training is anticipated to be extended to all other commissions of the response and all the rural areas of the province. The INRB COVID-19 Laboratory will soon be supplied with consumables necessary for the processing of samples and analyses.

Mozambique

The Instituto Nacional de Saúde/ National Institute of Health (INS) is a public health institute that belongs to the Ministry of Health in Mozambique. Its main mandate is to generate evidence for public decision and planning and its main activities include biomedical and sociological research, epidemiological surveillance, laboratory reference services and training, and communication. In efforts to strengthen preparedness and emergency response activities caused by the COVID-19 pandemic under the project, the INS made notable achievements in four areas:

AfyaData

AfyaData is a SACIDS-developed open source digital disease surveillance tool that eases the collection, analysis, documentation and feedback of public/animal health events. It is a set of two applications – a mobile android based client and a web-based application acting as a server. The mobile client is used for collecting and submitting surveillance data, and receiving and/or tracking feedback from various levels. The server component caters for data storing/hosting and management.

Review of the national acute respiratory illnesses surveillance system

The INS supported the Ministry of Health to establish 48 new sentinel sites. INS also introduced *AfyaData* (a digital surveillance tool) to event-based/ community-based surveillance as a means of strengthening the surveillance system. To support contact tracing investigations on surveillance, INS purchased emergency kits (including PPE) for field teams and conducted



Figure 1: Training participants from Mbanza Ngungu, Kongo Central province.

contact tracing on COVID-19 suspect cases. INS also maintained regular communication among sentinel sites and the laboratory to ensure effective coordination on data and sample collection at each site.

Build and maintain an information management system for surveillance data

The INS provided daily reporting of laboratory and epidemiologic data to the government dashboard (<https://covid19.ins.gov.mz/>), and routine epidemiological and laboratory reporting to the National Public Health Directory, and provided training to Data Management and local surveillance teams in all health facilities (53 sentinel sites) on the management of the severe acute respiratory infections (SARI) Database.

Enhance sentinel surveillance for SARI and COVID-19

Sentinel sites received specimen collection kits which were purchased under the project. Refresher training on case definition, sample collection, packaging and storage was conducted in seven of the eleven provinces, including sentinel sites, along with biosecurity and biosafety training in six transfrontier provinces (Niassa, Cabo Delgado, Tete, Manica,

Gaza and Maputo). An observational study on people's behaviour on the use of masks during rush hour in public places was undertaken to evaluate the availability and use of masks in the context of COVID-19 prevention.

Enhance SARS-CoV-2 testing and reporting capacity at the national reference laboratory

The INS expanded the capacity of local detection of SARS-CoV-2 infection in two provinces that allow for early detection and to increase identification of COVID-19 patients, and also conducted a Training of Trainers (ToT) to decentralise COVID-19 diagnostic laboratories in the northern and central regions using GenExpert® and Abbott M2000 platforms. INS supported the Ministry of Health in reviewing Standard Operating Procedures (SOPs) for all laboratory methods according to WHO policies to use GenExpert® and Abbott equipment across the country. Laboratory consumables and reagents were ordered for distribution across all regions. Plans are underway to supply SARS-CoV-2 samples to SACIDS headquarters for genome sequencing in order to monitor the spread of viruses and their continuous evolution to inform the contribution of neighbouring countries in the epidemiology of SARS-CoV-2 in Mozambique. Other activities planned under the project include strengthening

COVID-19 surveillance activities in transfrontier provinces, especially in cross border movements; strengthening collaboration between veterinary and human health authorities at all levels; and conducting event-based surveillance activities focused on community-level using *AfyaData*. In enhancing the use of digital technology for community-based surveillance, mapping of the strategic country sites and identification of ToTs for the initial deployment of *AfyaData* is in progress.

Zambia

Zambia recorded its first COVID-19 case on March 18, 2020 from two residents who were returning from Europe. By June 30, 2020, that number had risen to 1,590 cases with 24 deaths (Zambia National Public Health Institute, ZNPHI). Under this project, ZNPHI is being supported to conduct event-based surveillance using mobile technologies at points of entry in five districts: Chirundu, Chililabombwe, Lusaka, Kazungula and Nakonde. To date, 158 smartphones and 7 tablets have been procured for surveillance, and 30 community-based volunteers (CBVs) and 10 members from the District Epidemic Preparedness, Prevention and Control Committee have received training on event-based surveillance (EBS) in Nakonde district.

Under diagnostic services, four laboratory staff from the Tropical Diseases Research Centre (TDRC) and five laboratory staff from Macha Hospital received training on how to diagnose COVID-19 using real-time reverse transcription polymerase chain reaction (qRT-PCR). Laboratory consumables and reagents were procured. On the invitation of the provincial Permanent Secretary, the University of Zambia (UNZA) ACEIDHA conducted an assessment of the capacity and requirements of the provincial laboratory in Chipata, Eastern province, to diagnose COVID-19 cases. The assessment report was provided through the Vice Chancellor of the University of Zambia (UNZA) to the Permanent Secretary. The report was used by the Ministry of Health to assist the province with GenExpert cartridges for COVID-19 diagnosis. The province is now able to diagnose COVID-19 cases.

Tanzania and SACIDS Regional Programme

The COVID-19 Index case in Tanzania was confirmed on March 16th, 2020 associated with a traveller who had returned on a flight from Europe. Soon after that there were 2 other

independently introductions: the first related to test-positive cases in Dar es Salaam/Zanzibar associated with a small number of passengers on flights from Europe and one passenger on a flight from South Africa. The third early case involved a lorry driver who had crossed from a neighbouring country. The role of SACIDS in Tanzania and in the rest of the region was to provide expertise, advice and training to support national action by national authorities plus, as needed, undertake some defined Government commissioned activity.

This support and coordination programme was undertaken under the following 4 components:

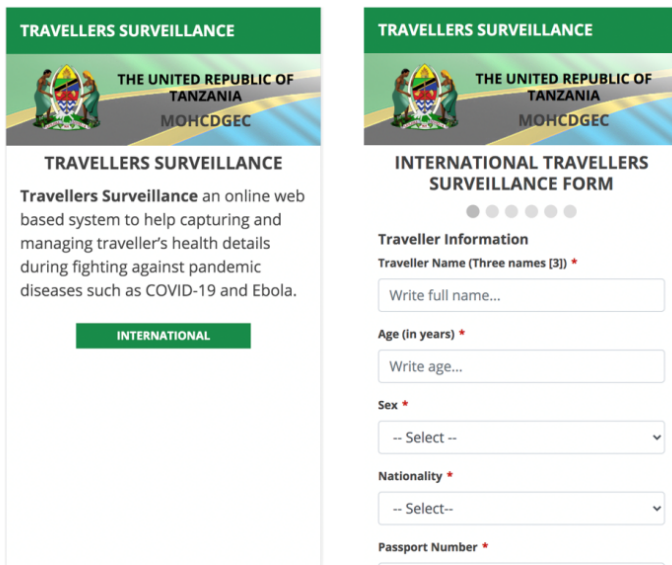
Component 1: Strengthening of the surveillance systems

Under this component, SACIDS is focusing on the designing and deployment of African-specific technology-driven solutions to enhance early detection and prompt response to public health events suggestive of COVID-19 at the point of entry (PoE) and community levels.

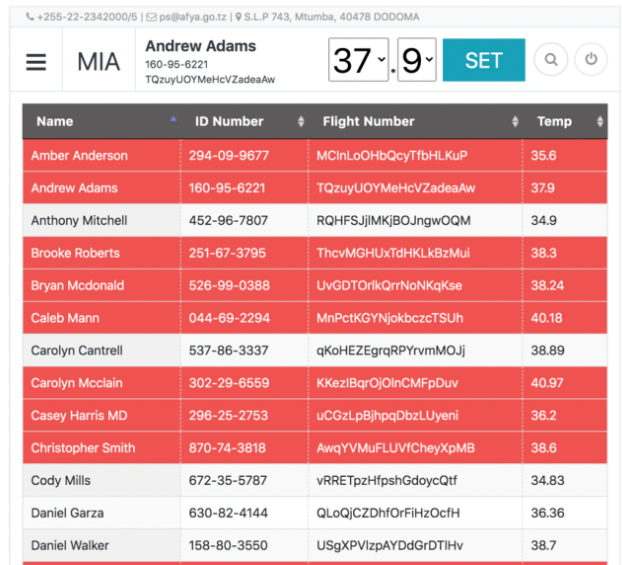
Digital tools for event-based surveillance at the PoE

A baseline assessment was conducted with the Tanzania Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC) and its PoE staff to understand the functionality of the surveillance, identify gaps, user requirements and existing potentials to strengthen it in the context of COVID-19. Based on the gaps observed at the PoE, a conceptual framework was jointly developed to guide the development of simple and an easy-deployable digital platform for targeted surveillance, active monitoring and contact tracing of COVID-19 suspected cases. Furthermore, screening, testing and self-quarantine follow-up workflows were developed as an integral part of the digital platform.

Digital tools powered with COVID-19 knowledge repository to enhance active surveillance of suggestive COVID-19 clinical manifestations for both the national and international travellers have been developed (Fig. 2). PoE health surveillance forms have been digitized to facilitate their completion by the travellers using smartphones, tablets or computers at their points of origin and therefore enhancing the preparedness and decision support at the point of the traveller destinations. The training module



Travelers fill out health information online (WebApp)



Port health officials use data to screen Travelers

Fig. 2: Screenshots of the Port of Entry Surveillance System. Note: all data are fictitious.

has been developed for users of PoE digital surveillance platform.

The establishment of a mechanism for integrating the collected data from PoE to the national health surveillance system is in progress, and it is hoped that the technology will be transferred to other interested countries in Africa.

Training module for community COVID-19 surveillance

SACIDS in collaboration with the Africa CDC, has developed a training module for community-based COVID-19 surveillance (including contact tracing). The module targets community health workers (CHWs) in the Africa context as early signal sensors and responders to disease outbreaks and other public health events. The module has been approved by the Africa CDC and translated into the major African Union languages.

Supporting Mozambique to adopt digital technology for community-based surveillance

As part of the on-going collaboration between SACIDS and the Ministry of Health in Mozambique, the authorisation of the implementation of *AfyaData* in the country by the National Institute of Health will pave the way to mapping of the surveillance sites and identification of ToTs.

Component 2: Provision of diagnostic support

The project has enabled the setup for the diagnosis of COVID-19 by provision of expertise and materials to Government public health laboratories in the DRC, Mozambique and Tanzania, and to university laboratories at the University of Zambia (UNZA) in Zambia and Sokoine University of Agriculture (SUA) in Tanzania. In DRC and Mozambique, the National Institute for Biomedical



Figure 3: The role of SACIDS-ACE in expert support to the Ministry of Health during COVID-19 pandemic.

Research and the National Institute of Health, respectively, are serving as national COVID-19 diagnostic laboratories. The UNZA Laboratory is conducting extensive testing of SARS CoV-2 for the country as a node of the Zambia Public Health Laboratory, and the SACIDS Molecular Biology Laboratory serves as a back-up laboratory to the National Public Health Laboratory in Tanzania, on as needed basis (Fig. 3).

Also in Tanzania, a Materials Transfer Agreement is underway in order to enable the complete genome sequencing of SARS CoV-2 in samples from Mozambique. Capability for on-site real-time genomic surveillance has been built to serve as a mobile genomics laboratory equipped with mobile thermocycler and Oxford nanopore sequencers, deployable for real-time sequencing at point of need (Fig. 4).



Figure 4: SACIDS-ACE mobile genomics laboratory for real-time genomics of pathogens and antimicrobial resistance.



In the fight against the ninth epidemic of Ebola virus disease in the Equateur Province, the DRC set up a sequencing laboratory at the National Institute of Biomedical Research in Kinshasa in July 2018. This was made possible by the collaboration of several partners - Institute of Research for Development (IRD) in France, Institut Pasteur in Dakar in Senegal, US Army Medical Institute of Infectious Diseases and University of Nebraska Medical Centre. Furthermore, on September 26, 2020, Dr. Katendi Changula of the School of Veterinary Medicine, Africa Centre of Excellence for Infectious Diseases in Humans and Animals (ACEIDHA) at UNZA, is a veterinarian and researcher who has researched on the Ebola virus disease and SARS-CoV-2, presented a talk on examining diseases that affect both humans and animals at TEDx Lusaka, Zambia. Dr Changula was the first SACIDS-sponsored PhD student at UNZA who developed a point of care diagnostic for EVD, that was deployed during the 2020 EVD in DRC.

Component 3: Assessing the COVID-19 risk and mitigation strategies that are context-specific for Africa

In an effort to generate knowledge, research and evidence-based strategies and tools, four analyses were undertaken:

- Situational analysis of response to COVID-19: What works and does not work?

- Risk Analysis of the Health System Resilience to COVID-19 Pandemic in Mozambique, Tanzania and Zambia
- Response of the social systems to COVID-19 in Mozambique, Tanzania and Zambia: challenges and opportunities
- Analysis of similarities and differences in information about COVID-19 published through the health authorities' websites in 16 Southern African countries

These analyses note the relative young population of Africa compared with Organisation for Economic Co-operation (OECD) countries, as being a potential mitigation factor in terms of mortality outcomes. A combination of this observation with that from the sociological studies above that the extended family living arrangements in Africa might be a protection to vulnerable elderly population could be part of a combination of socio-anthropological mitigation factors, especially in rural areas, despite the relatively weak health systems in Africa

Component 4. Making advancements in scientific research and technology

SACIDS is currently undertaking research and development work through its various projects and initiatives to address infectious diseases in eastern and southern Africa that will lead to better risk analysis, country preparedness, and improved planning and response:

Antimicrobial Resistance

The antimicrobial resistance (AMR) research activities in SACIDS are led by the AMR Community of Practice (AMR CoP). This CoP was formed in 2013 to address the burden of AMR in the southern African region and therefore, contributes to the global effort. It is centred on examining the phenotypic and genomic epidemiology of AMR in the context of health systems and the analysis of the socio-economic and policy analysis approaches to define the scale and the impact of AMR. Our initial seven years of work have revealed several findings to a better understanding of antibiotic resistomes between humans, animals and the environment.

Recognition

We have been appointed by the Africa CDC to operationalise the Africa Union Framework for AMR. We are currently helping Africa CDC to undertake a systematic review of existing policies on antimicrobial use in agriculture/ food production systems in Africa and in performing cost benefit analysis of Infection, Prevention and Control (IPC) interventions on the African continent.

We are also working with the Anti-Microbial Resistance Surveillance Network (AMRSNET), a network of public health institutions and leaders from human and animal health sectors collaboratively to measure, prevent, and mitigate harms from AMR organisms.

With further support from World Bank, Medical Research Council UK (MRC–UK), Fleming Fund, and collaboration with the London School of Hygiene and Tropical Medicine (LSHTM), American Society of Microbiology (ASM), Ending Pandemics, our programme is:

- Expanding to address gaps in AMR data management, antimicrobial stewardship, AMR surveillance system in Tanzania and Uganda, which is critical for informing patient and animal care;
- In Zambia, the Fleming Fund is supporting AMR data management and antimicrobial stewardship using a One Health approach with *Salmonella*, *Escherichia coli*, *Klebsiella* spp, *Campylobacter* and *Staphylococcus aureus* as examples.
- Gap analysis in AMR and antimicrobial use (AMU) surveillance systems has been conducted in West, East and Southern Africa to develop simple common protocols, using highly standardized and reproducible methodologies, to tackle One Health AMR surveillance in low- and middle-income countries.
- SACIDS is now in the process of identifying and prioritising potential interventions in the public and animal healthcare

sectors that can be tested using appropriate epidemiological designs and incorporating suitable evaluation methods to measure their impact.

Lessons Learned

Stronger collaboration efforts and global cooperation is needed to protect human and animal populations from future catastrophes. Such joint efforts, for example, strengthening COVID-19 emergency preparedness in Africa, are complementary and contribute to the African Continental Strategic Plan for COVID-19 Pandemic.

The triple epidemic of COVID-19, Ebola virus and AMR in Africa has necessitated for having, in situ, in Africa, relevant One Health expertise for disease surveillance and pathogen detection/ identification, especially at the human, animal and environment interface. Moreover, promoting Africa-led smart partnership with global expertise to fast-track access to emerging development in genomics and artificial intelligence (AI) driven analysis of complex data, the need to safeguard Community-Level One Health Security, and to lead to National and Global Health Security.

The Africa Higher Education Centers of Excellence

The Africa Higher Education Centers of Excellence (ACE) initiative was launched by the World Bank and African Governments as a key step toward implementing this solution across Africa. Its first phase, ACE I was launched in 2013 for West and Central Africa, 22 Centers of Excellence across eight countries in three priority sectors – STEM (science, technology, engineering and mathematics), Agriculture, and Health. Building on the ACE I experience, the second phase, the Eastern and Southern Africa Higher Education Centers of Excellence (ACE II) seeks to strengthen selected eastern and southern African institutions to deliver quality post-graduate education and build collaborative research capacity in five regional priority areas: industry, agriculture, health, education and applied statistics.

Additionally, with the designation of two Africa Centres of Excellence for Infectious Diseases of Humans and Animals (ACE-IDHA) by the World Bank at the Sokoine University of Agriculture in Morogoro, Tanzania (the SACIDS – ACE) and the University of Zambia (ACEIDHA) in 2016/2017, SACIDS aims to address the concern for a high burden of infectious diseases in Africa and yet a low capacity for its risk management. Our training strategy focuses on developing students who can apply the principles of molecular biology or epidemiology in a One Health context to the understanding and management of infectious diseases, through a tiered postgraduate training programme. The emphasis is on self-driven learning, which aims to develop critical thinking skills and retaining knowledge that leads to self-actualisation.

In doing what we do, we hope to create a talented pool of specialists for the provision of expertise at national and regional deployment in cases of emergencies, and provide lessons for other member networks in other parts of the world such as the Connecting Organizations for Regional Disease Surveillance (CORDS), which, together, would be part of the Global Early Warning/surveillance in line with the concept on containment of epidemics.

Finally, we note that, unlike in previous major epidemics, SACIDS academic and research expertise was available, in situ, in all 4 countries to support national authorities with their appropriate early response right from the point of index cases. This was also true for the 6 EAIDSNet countries. There was also ready Africa continental coordination by the Africa CDC. All this early detection, early response and coordination was possible thanks to the prompt early support by the Skoll Foundation that helped to facilitate an enabling environment for subsequent traditional major international emergency support to governments and NGOs.

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SACIDS Mission

The Mission of the SACIDS Foundation for One Health is to undertake cutting edge, trans-disciplinary and multi-sectoral research that is impact orientated, prioritised and system based. This will be undertaken in southern, central and eastern Africa and where appropriate delivered through strategic partnerships with academia, research institutes, and international organisations.

SACIDS Vision

The SACIDS Vision targets the impact that in Africa the health and food security and livelihoods are measurably improved through mitigation of the impact of infectious diseases and antimicrobial resistance (AMR) on humans, animals and the environment.

About SACIDS for One Health

The SACIDS Foundation for One Health (SACIDS) is a ONE HEALTH Virtual Institute that links academic and research institutions in Southern and Eastern Africa, which deal with infectious diseases of humans and animals within the African Ecosystem, in an innovative South-South-North smart partnership with world-renowned centres of research and training. For details visit www.sacids.org

About the Skoll Foundation

The Skoll Foundation, founded by Silicon Valley entrepreneur Jeff Skoll in 1999, invests in, connects and celebrates social entrepreneurs and the innovators who help them solve the world's most pressing problems. For details visit www.skollfoundation.org.

About Ending Pandemics:

Provides scientific, technical and financial support to find outbreaks faster in emerging disease hotspots. For details visit <https://endingpandemics.org/>

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