

Towards one Africa, **one health**

Professor Mark Rweyemamu is the Executive Director of the Southern African Centre for Infectious Disease Surveillance, which promotes collaborative research across a number of international institutions into a wide range of conditions that blight the region



Could you begin by explaining the concept of One Health and where the Southern African Centre for Infectious Disease Surveillance (SACIDS) fits into this remit?

Broadly speaking, One Health is a holistic collaboration incorporating human, animal and environmental health to address public health issues. Beyond this there is not a universally agreed definition, so there is a tendency for different groups to define their own focus with regards to this approach.

As SACIDS is rooted in studying infectious pathogens – the majority of which have a propensity to spread between species – we have defined the SACIDS focus of One Health as: 'A collaborative effort between natural sciences and social sciences to advance the understanding of interactions between humans, animals and the environment to improve public and animal health'.

What were the circumstances which led to the formation of SACIDS?

The genesis of SACIDS is rooted in the realisation that Africa is the region with the highest burden of the most dangerous

infections for humans and animals, and yet the lowest capacity for their risk management and control. The evidence for this was most vividly provided by the 2004-06 UK Foresight Programme's study into contagious diseases. This research concluded that these afflictions would continue to be a formidable challenge to human welfare and economic development, and thereby impede Africa's ability to meet the UN Millennium Development Goals.

How did your professional background lead you to your association with the Centre?

I am a veterinarian and have spent all my working life focusing on infectious conditions – primarily those caused by viruses – at national, African regional and international levels. For 10 years I was the Head of the Infectious Diseases Programme of the Food and Agriculture Organisation (FAO) of the UN, and soon after that I was involved with the seminal Foresight Programme, leading its African strand. After that, I became involved in a series of stakeholder consultations that led to the formation of SACIDS in January 2008.

From where have you personally drawn inspiration to target infectious diseases in Southern Africa?

As a Tanzanian, Southern Africa – as defined as the Southern African Development Community (SADC) – is my home region. The SADC and the epidemiologically-linked East African Development Community are regions with probably the highest concentration of wildlife and thereby perhaps the most intense human-livestock-wildlife interaction. South Africa provides a benchmark and an opportunity for regional collaboration in developing the research capability for communicable diseases as, beyond South Africa, the region has inadequate capacity.

Following a lifetime of experience with infectious diseases from an international

perspective, the SADC was to me the most attractive region when it came to initiating a mission to develop the research capacity for both common and emerging infections.

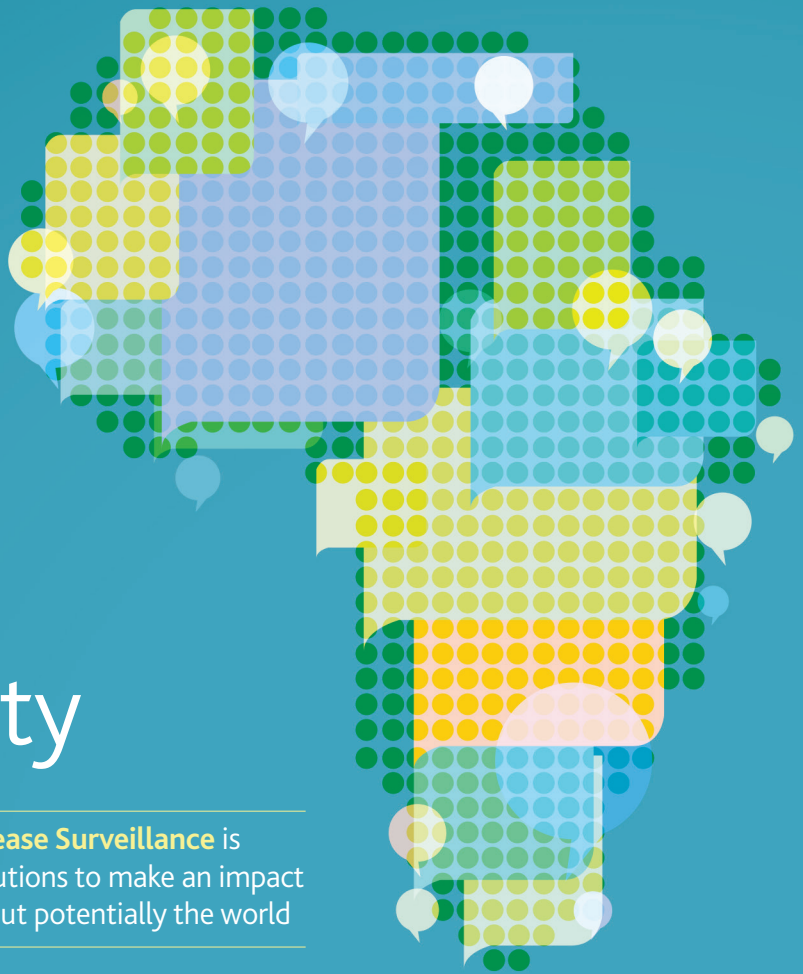
International partnerships – for example with other One Health initiatives – are a crucial component of SACIDS's work, but do you feel that self-sufficiency is crucial for the future of scientific research in African nations?

What I think is crucial is to develop *in situ* research competence in Africa so that local scientists are research partners – not simply research facilitators – for African and global health issues, and are able to deliver quality science. Africa both poses challenges and offers opportunities for research into infectious diseases. Our vision is for African scientists to be actively engaged in high quality research; being research leaders, working in smart partnership with others and not being isolationist in a world that is becoming increasingly globalised.

Can you highlight any particular cases where the Centre's approach has proved effective?

The foot-and-mouth disease research team are now generating molecular and epidemiological results that were considered farfetched in 2008; they are identifying hotspots in Zambia and Tanzania and have generated sequencing data which is beginning to raise questions about the generation of new variants. This team has started whole-genome sequencing of the foot-and-mouth virus and has developed a close working relationship with The Pirbright Institute, FAO and World Organisation for Animal Health regional reference laboratories in South Africa and Botswana. Also, the plague research team has for the first time isolated and sequenced the Yersinia bacterium in Zambia and Tanzania, where all previous data had been limited to either syndromic or serological studies.





Maximum research capacity

The Southern African Centre for Infectious Disease Surveillance is developing the research capacity for African institutions to make an impact on infections which threaten not only the region but potentially the world

THE SOUTHERN AFRICAN Centre for Infectious Disease Surveillance (SACIDS) states its mission as harnessing innovation in science and technology to improve Africa's capacity to detect, identify and monitor infectious diseases. The Centre takes a 'One Health' approach to these infections, encompassing not only humans, but also animals, ecosystems and the interactions between all of these components, in order to better manage the risk posed by them. Currently, institutions from the Democratic Republic of Congo, South Africa, Tanzania, Mozambique and Zambia are SACIDS members, and there are aspirations to expand to other Southern African Development Community member states.

Professor Mark Rweyemamu was driven to develop SACIDS following his work on the UK Foresight study into 'The Detection and Identification of Infectious Diseases'. While leading the African strand, it became clear that the continent was not prepared to deal with an ever-increasing disease burden, particularly from emerging conditions. The majority of these novel viruses (around 75 per cent) derive from zoonoses – contagious infections transmitted to humans from other species. Clearly these pathogens are crucial research targets, as they present a very real risk of initiating future pandemics which could devastate the health of both Africa and the world at large.

The far-reaching nature of this operation necessitates a holistic approach which tackles

all factors contributing to disease in the region. In line with this, SACIDS has developed four key research themes with broad jurisdictions: bacterial zoonoses; emerging and vector-borne diseases; viruses which affect food security and livelihood; and One Health sciences with a focus on cross-cutting issues.

MOBILE TECHNOLOGIES

One project that falls within the fourth research area is the application of mobile technologies to enhance surveillance and response at the point of outbreak. The focus here is on allowing data collection to be carried out in the field and reported via a smartphone application, a web application or a structured SMS message. Data are collected via two complementary procedures known as the Community-based Active Surveillance (CAS) system which uses simple definitions of clinical signs to allow reporters to actively screen for disease events, and the District-based Passive Surveillance (DPS) system, where more conventional strategies for data collection are utilised.

Data are then collected and collated from both schemes at a central server which facilitates data visualisation and manipulation by interested parties. Permission can be controlled at this point, with various levels of access being allowed depending on the user's position. In this way, remote operators are able to track the spread of transferable pathogens and to rapidly

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inform relevant individuals and organisations, including medical centres in areas at risk, national and international aid agencies, and government officials.

In order to coordinate and develop this data collection, a number of National Centres for Disease Surveillance (NatCIDS) have been established. The hierarchical structure which is being developed from the overarching principles of One Health down through to SACIDS and then the institutional level allows in-depth and case-specific study while also allowing general trends and international pandemic risks to be followed.

TRAINING AND DEVELOPMENT

Of course, developing these research areas requires qualified individuals to pursue the work. With that in mind, the Centre has implemented several postgraduate level courses, including

One Health-based MSc courses in analytical epidemiology and molecular biology – the first of their kind in Africa – and multiple MPhil/ research MSc, PhD and postdoctoral research opportunities. SACIDS is currently sponsoring 71 scientists across these programmes in an effort to train a new generation of young science leaders. This increased capacity is highlighted by the steady output of research papers being produced by SACIDS, with around 40 published since its formation.

This influx of new researchers will drive Africa's capacity for research and provide internally generated solutions to the region's problems. One such problem is the current tendency for syndromic surveillance, which diagnoses patients based solely on symptoms and cannot easily differentiate between specific conditions. This makes tracking infections highly challenging or even impossible. Previously, the possibility of determining the aetiology of an illness has been out of reach, but there is now an increasing drive for specific diagnosis, primarily through DNA sequencing. Not only will this allow for more efficient and effective treatment, but it raises the possibility of diseases or even specific strains being tracked and controlled.

BRIDGING THE GAP

One key issue in the approach that SACIDS takes is the vast geographical area across which their surveillance and research is being carried out; particularly as there are marked differences in the levels of infrastructure and research focus present across the countries involved. They have developed a number of strategies to deal with these problems and ensure that they can reliably provide services to the broadest possible array of people.

The SACIDS team is utilising a Virtual Centre concept which works to improve collaboration across borders, disciplines and administrative dividing lines. This allows the various institutions to work together and address infectious disease at the geographical and zoological source. Similarly, their Community of Practice approach encourages theme-based research across sectors, institutions and countries.

Whilst SACIDS has a focus on increasing the research capacity within Africa itself, they are also collaborating with non-African institutions at the discovery end. These so-called 'Smart Partnerships' – which include associations with six University of London colleges (especially London School of Hygiene & Tropical Medicine, the Royal Veterinary College and the School of Oriental and African Studies) under the umbrella of the London International Development Centre, The Pirbright Institute, the International Livestock Research Institute and Connecting Organizations for Regional Disease Surveillance (CORDS). Their aim is to promote the international dissemination of knowledge and allow institutions with lower levels of funding and expertise to drastically improve their research.

GREEN SHOOTS

The project is still in its infancy, and Southern Africa has a long way to go to reach the level of research capacity required, but Rweyemamu is optimistic: "Within the short period of four years, we are beginning to see promising green shoots," he enthuses. "Already we are seeing molecular biology technologies becoming embedded in the research activities of even our MSc students, and our PhD students are advancing to DNA sequencing of pathogens."

It is through integration across research disciplines and development of people that real results will be seen in the long term. The SACIDS approach will hopefully lead to a time when Africa is not reliant on external institutions for cutting-edge research, but instead will collaborate with the international scientific community as equals to provide global benefits.

Africa's disease burden

Africa as a whole suffers from one of the highest burdens of infectious diseases for both animals and humans in the world, and yet it also possesses the lowest capacity for control of these diseases. This is the situation that SACIDS seeks to tackle, but first it must overcome a host of geographic and socioeconomic factors that have led to this state of affairs

POVERTY: Infectious diseases inevitably have greater impact on poor communities and poor countries.

ENDEMIC SETTINGS: There are many infectious diseases, such as tsetse fly-transmitted trypanosomiasis, that are entirely unique to Africa.

ECOSYSTEMS AND LAND USE: The encroachment of people onto wildlife habitats could lead to transmission of disease between wildlife and livestock, and even humans.

CULTURE AND GOVERNANCE: In many African countries, the legal systems tend to focus more on punitive actions than on changing habits or conditions that predispose populations to disease.

INADEQUATE CAPACITY This goes beyond the lack of money and infrastructure, both of which are well recognised as impediments. Science is poorly funded in most African countries as a per cent of GDP, let alone in absolute terms.

INTELLIGENCE

SOUTHERN AFRICAN CENTRE FOR INFECTIOUS DISEASES AND SURVEILLANCE (SACIDS)

OBJECTIVES

A One Health Virtual Centre that links academic and research institutions in Southern Africa which deal with infectious diseases of humans and animals, in an innovative partnership with world-renowned centres of research in high-income countries

PARTNERS

Democratic Republic of Congo: Institute of Public Health, Faculty of Medicine, University of Kinshasa; Central Veterinary Laboratory, Kinshasa; National Institute for Biomedical Research

Mozambique: Faculty of Veterinary Medicine; Faculty of Medicine, Eduardo Mondlane University; National Health Institute, Ministry of Health

Tanzania: Muhimbili University of Health and Allied Sciences; National Institute for Medical Research; Faculty of Veterinary Medicine, Sokoine University

Zambia: School of Veterinary Medicine; School of Medicine, University of Zambia

South Africa: National Institute for Communicable Diseases; Onderstepoort Veterinary Institute; Faculty of Veterinary Science, University of Pretoria; Medical School, Stellenbosch University, Cape Town

UK: London International Development Centre; Royal Veterinary College; London School of Hygiene and Tropical Medicine; The Pirbright Institute

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