TEN YEAR EXPERIENCE DEVELOPING ONE HEALTH CAPACITY IN AFRICA







SACIDS Foundation for One Health
www.sacids.org

TEN YEAR EXPERIENCE DEVELOPING ONE HEALTH CAPACITY IN AFRICA

by **Professor Mark Rweyemamu**, Executive Director, The SACIDS Foundation for One Health. Sokoine University of Agriculture (SUA), Morogoro, Tanzania and Visiting Professor at SUA, Tanzania and Royal Veterinary College (RVC), UK

In collaboration with:

Janusz Paweska, Head Centre for Emerging and Zoonotic Diseases, National Institute for Communicable Diseases of the National Health Laboratory Services, Johannesburg, South Africa and Deputy Director, SACIDS (Human Health)

Dominic Kambarage, Vice-Chancellor, Mwalimu Julius K. Nyerere University of Agriculture and Technology, Tanzania and Deputy Director, SACIDS (Animal Health)

Joe Brownlie, Emeritus Professor Royal Veterinary College, University of London, Lead Scientist of the 2004 – 2006 UK Foresight Study on Infectious Diseases, Member SACIDS Governing Board

Koos Coetzer, Professor of Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Member SACIDS Governing Board

Dácia Correia, Professor Faculty of Veterinary Medicine, Eduardo Mondlane University, Maputo Mozambique Member SACIDS Governing Board and SACIDS Programme Coordinator in Mozambique

Jean-Marie Kayembe, Professor and Dean Faculty of Medicine, University of Kinshasa, Member SACIDS Governing Board and SACIDS Programme Coordinator in Democratic Republic of the Congo

Esron Karimuribo, Associate Professor, Director for Postgraduate Studies, Research, Technology Transfer and Consultancy, Sokoine University of Agriculture, Tanzania, First SACIDS Postdoctoral Research Fellow and currently SACIDS Research Coordinator for Cross-cutting One Health Sciences

Mecky Matee, Professor Microbiology and Immunology, Muhimbili University of Health and Allied Sciences, Tanzania and SACIDS Research Coordinator for Antimicrobial Resistance, Member SACIDS Governing Board and SACIDS Programme Coordinator in Tanzania

Gerald Misinzo, Associate Professor of Virology, College of Veterinary Medicine and Biomedical Sciences, Sokoine University of Agriculture and Leader SACIDS Africa Centre of Excellence for Infectious Diseases of Humans and Animals in Eastern and Southern Africa, Tanzania

Aaron Mweene, Associate Professor of Virology, School of Veterinary Medicine, University of Zambia and Leader Africa Centre of Excellence for Infectious Diseases of Humans and Animals, Zambia

The period between 1990 and 2010 was characterised by a wave of animal and human infectious disease epidemics of international concern and even pandemic proportion. This was also the period associated with an upsurge or resurgence of emerging or re-emerging diseases, namely epidemic diseases caused by newly recognised pathogens or variants of previously known pathogens. A key reaction of the international community, through the World Health Organisation (WHO), the Food and Agriculture Organisation (FAO) and the World Organisation for Animal Health (OIE) either alone or jointly, was to set up new initiatives for improving early warning, preparedness, international response and coordinated regional disease control programmes such as the FAO EMPRES programme, the WHO GOARN programme, the FAO-OIE Global Framework for Transboundary Animal Diseases (GF-TADs), the FAO-OIE-WHO Global Early Warning System and the Avian Influenza control programme.

There were also several internationally commissioned studies directed at assessing the cause and risk posed by the changing nature of epidemics. The most notable of such studies was that by the UK Foresight programme which involved over 400 leading scientists from around the world. This foresight study assessed the risk over a 30-year horizon (with some aspects, like effects of climate change, being over a much longer horizon). In addition to the global perspective, this Foresight study included also a specific focus on Africa. The study identified major risks as due to: (i) new pathogens or new strains of existing pathogens arising through natural genetic change; (ii) new diseases from animal species reservoirs, including wild species; (iii) emergency of drug-resistant organisms and (iv) geographical spread of pathogens exacerbated by globalisation and climate change. For Africa, the study identified additional risks including the persisting high prevalence and burden of infectious diseases, legislation, governance, economic factors, civil conflict and inadequate coordinated research capacity by African scientists within Africa. A key conclusion was that Africa required a quantum leap in developing, in situ, its research and disease risk management capacity. There was also need for an African CDC and regional research and training hubs for the detection, identification and monitoring of infectious disease causing pathogens.

Formation of SACIDS

The lessons for Africa were consolidated first through a specific consultation of African scientists with expertise on infectious diseases of either people or animals or plants at a special workshop in 2005 in Entebbe: The Foresight Entebbe Workshop. Then at the end of 2007/early 2008 stakeholder consultations in Southern Africa culminated in a regional workshop in Pretoria, South Africa.

So, faced with the conundrum of a high burden of infectious disease yet low capacity for its risk management, representatives of academic and research institutions in 5 Member States of the Southern African Development Community (SADC) – Democratic Republic of the Congo, Mozambique, South Africa, Tanzania and Zambia, resolved to form, in January 2008, the Southern African Centre for Infectious Disease Surveillance (SACIDS) to address infectious diseases in the endemic settings of Africa, through a collaborative effort between natural and social sciences to advance the understanding of interactions between humans, animals and the environment to improve public and animal health. SACIDS was conceived as a joint initiative between the public health and animal health universities and national research institutions dealing with infectious diseases of humans or animals including wildlife. The modus operandi selected was one of a joined up collaboration across sectors and across institutions with a shared Mission for harnessing innovations in science and technology in order to improve Africa's capacity to detect, identify and monitor infectious diseases of humans, animals and their interactions, in the African ecosystems, in order to better manage the risk posed by them. The Founding institutions peer-elected Sokoine University of Agriculture in Tanzania to host the Secretariat and Headquarters of SACIDS.

How We Work

The research and training programmes of SACIDS are rooted in the One Health approach. In line with the SACIDS mission, we seek to develop core competences in 3 domains, namely:

- Molecular biology to study pathogens and their interaction with humans, animals and the African ecosystems;
- Analytical epidemiology to identify factors, including environmental, cultural, socio-economic and commercial that influence disease spread within and between populations of people or animals, including between countries and regions of the world. Use such data to develop risk and prediction models for the spread of infectious disease in Africa;
- Social sciences including economics, sociology and socio-anthropology to define human behaviour factors that favour disease spread and/or the design of effective measures for disease prevention or control in Africa.

Our core strategy encompasses 3 approaches: (i) to function as a Virtual Centre that pools the best of human and physical resources across the participating African universities and research institutions; while the Headquarters of SACIDS has been at Sokoine University of Agriculture in Tanzania in each of the participating countries one institution was nominated for national coordination (NatCIDS Coordination); (ii) An African coordinated smart South-South-North partnership of African and non-African academic and research institutions that share the Mission of SACIDS; (iii) theme based research linking subject matter specialists, research students and postdoctoral fellows to constantly interact together as a Community of Practice.

Developing Capacity for One Health Research for Infectious Disease

Our cohorts of scientists now undertake research programmes that address key aspects of the infectious disease burden in Africa:

- Emerging and mosquito-borne diseases – including developing diagnostic capability for Ebolavirus, risk modelling of mosquito-borne viral diseases;
- Viral diseases that constrain food security and livelihoods – e.g. foot-and-mouth diseases, Peste des Petits Ruminants and African swine fever; developing expertise in genomics that is now being applied across other SACIDS research strands;
- One Health focus on Mycobacterial infections, bacterial zoonoses and on the genomic surveillance of antimicrobial resistance;
- Community-level One Health based participatory disease surveillance aided by in-house developed mobile technology applications (AfyaData http://afyadata.sacids.org/about)
- Health and Food Systems analyses.

On the training side, we introduced the first One Health based MSc programmes in Africa, a 4-year PhD programme that includes structured training in enabling and leadership skills and a Postdoctoral research fellowship programme to stimulate transformative research approaches within our universities that were previously over-dominated by teaching.

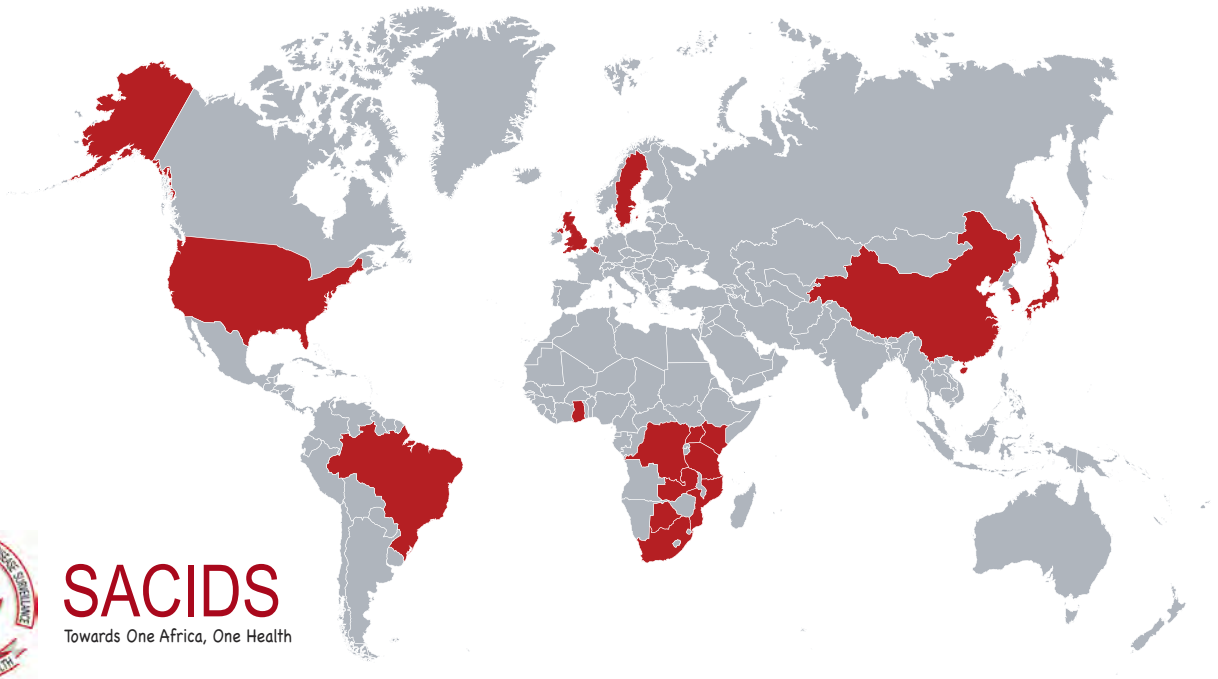
Over the past 10-years, we have enrolled:

- 19 Postdoctoral Research Fellows
- 32 PhD students
- 16 MPhil students
- 79 One Health based MSc students

Our Smart partnership now includes 26 institutions drawn from within Africa, UK, Europe, USA, Brazil, South and East Asia.

Our alumni include 6 Associate Professors, 2 Full Professors, a

SACIDS South-South-North Smart Partnership



SACIDS
Towards One Africa, One Health

Deputy Vice-Chancellor, a National Chief Veterinary Officer and a Wellcome Trust Intermediate Research Fellow.

Our overall programme has recently been subjected to independent evaluation[1], which has found SACIDS to remain well focused on its One Health objective despite carrying out its operations in a difficult landscape.

Evolution of SACIDS towards Sustainability

From the outset, we set up SACIDS with a long term objective towards a sustainable entity. So, we named it a Centre and put in place governance structures, like a Governing Board and an independent international scientific advisory board, that are generally associated with established organisations. Our programme of work was to be supported from several sources to avoid the vulnerability of single funding source dependency.

The vision and mission of SACIDS are rooted in enhancing Africa's capacity for the science evidence that enables successful prevention and control of infectious diseases of people and animals (livestock, wildlife and fish) through the One Health approach, which involves collaboration between researchers and practitioners in the public health, animal health and environmental sectors to improve public and animal health.

At the end of the first 5 years (ie in 2013) we reviewed SACIDS and developed a business plan for the next 5 years, which was launched by the Vice-President of the United Republic of Tanzania. At the core of this plan was an objective to strive to convert SACIDS from a regional programme to a regional centre.

In 2016/2017, the SACIDS programme in Tanzania and Zambia led to 2 World Bank designated Africa Centres of Excellence for Infectious Diseases of Humans and Animals, thanks to funding

by the Governments of Tanzania and Zambia and the World Bank. This has been a significant step towards mainstreaming SACIDS programmes. It has encouraged the Governing Board of SACIDS, in 2017, to develop a new strategic framework for SACIDS that should guide SACIDS as a regional One Health Foundation/ Institute for the next decade, based on the following Five Strategic Goals:

SG1: *To become an African-led Foundation, which is globally recognized to have 'revolutionized' detection, identification and monitoring of infectious diseases in Africa*

SG2: *To integrate and consolidate core competencies in Research and Development into groupings of "communities of practice" across Africa and globally.*

SG3: *To sustain and grow SACIDS' financial resource base by embarking on income generating ventures and by tapping from public and private sectors and other sources.*

SG4: *Enhance SMART Partnerships and networking*

SG5: *Transform SACIDS research strategy and structure to accommodate the "Theory of Change" to achieve One Health Security at the community level*

At its 153th Session, the Council of Sokoine University of Agriculture (SUA) accepted the recommendation by the SACIDS Governing Board and the University Senate to establish, under the SUA Charter, the SACIDS Foundation for One Health, owned by the SACIDS Founding Institutions that will have a wider and stronger capability to address the strategic goals over the next 10 years.

[1] Hanin et al., 2018. Front Vet Sci. 5:33. doi: 10.3389/fvets.2018.00033.

Acknowledgement

We acknowledge the support and collaboration by the management and staff of Sokoine University of Agriculture, which hosts the SACIDS Secretariat and those of the other founding institutions in Tanzania, Democratic Republic of the Congo, Mozambique, South Africa and Zambia, our founding UK partners: Royal Veterinary College (RVC), London School of Hygiene and Tropical Medicine (LSHTM) and The Pirbright Institute; CORDS and CORDS associated Networks in Africa, Middle East, Southeast Europe and Southeast Asia; all the new partners from Africa, Europe, USA, Canada, Brazil, Belgium, Republic of Korea, Japan and China for their collaboration which now enables the SACIDS Foundation for One Health to operate as truly a South-South-North Smart Partnership.

We acknowledge the support and encouragement from the Foresight Unit of the UK Science and Innovation, the 4 science leaders of the 2004 – 2006 Foresight Study on Infectious Diseases – Preparing for the Future and the 3 African scientists who coordinated the Africa strand of that study.

We acknowledge the support from various agencies that have funded our work since 2008 including: Google Foundation, Rockefeller Foundation, Wellcome Trust, African Development Bank, IDRC of Canada, Skoll Global Threat Fund, Ending Pandemics, FAO, GALVmed, UK Medical Research Council, UK-GCRF-BBSRC, European and Developing Countries Clinical Trials (EDCTP), National Institute of Health of the Republic of Korea, CORDS (with funding from Rockefeller, Bill & Melinda Gates and Skoll Global Threat Fund), The partnership for skills in applied sciences, engineering, and technology (PASET), World Bank, and the Governments of Tanzania and Zambia.

Professor Mark Rweyemamu, Executive Director,
SACIDS Foundation for One Health

Sokoine University of Agriculture
P.O. Box 3297, Chuo Kikuu, MOROGORO, Tanzania
secretariat@sacids.org
www.sacids.org

THE PRIORITIES FOR TACKLING INFECTIOUS DISEASES IN AFRICA

In this interview, public health specialist Dr Wilfred Alexander Chalamira Nkhoma from the World Health Organization (WHO) Office for the Africa Region speaks to us about the priorities for tackling infectious diseases in Africa, with a particular focus on Tuberculosis (TB) and viral hepatitis

On the priorities for tackling infectious diseases in Africa, with a particular focus on Tuberculosis (TB), Dr Wilfred Nkhoma from the World Health Organization (WHO) Office for the Africa Region explains that the traditional way to treat and control communicable diseases revolves around the three standard domains of public health.

The first domain is primary prevention which is about what actions are taken by the health system or the individual to protect themselves from or to prevent diseases. Actions here include improving living conditions or immunisation, for example. The second domain is secondary prevention, that revolves around the identification of infection or active disease and taking actions to modify what one finds. Here, ordinarily, you identify what diseases you are dealing with and when you do find something, you should link people to the appropriate treatment that works, Dr Nkhoma underlines.

The third domain is tertiary prevention, which means you are dealing with somebody who already has a disease and they have developed complications but you want to maintain and improve their quality of life. The same principles apply to diseases such as Tuberculosis (TB), Dr Nkhoma tell us, which people can pick up when they are exposed to TB causing germs in community settings where they live or in households where they are in close proximity to somebody who already has this infection. Therefore, people need to take steps to improve their own health and governments need to deliberately invest in improving the social economic status and living conditions of their people, Dr Nkhoma argues. He goes on to detail additional priorities to tackle infectious diseases, in his own words.

"The prevalence and incidence of TB and other infectious diseases are very high, so there must be universal access to quality diagnosis and uninterrupted supply of effective quality-assured medicines for timely treatment close to where the people live. We should also have programmes and systems that support those patients in the event that they develop complications and disabilities from that infectious disease, so their quality of life does not become unbearable."

While people infected with TB bacteria have a 10% lifetime risk of falling ill with it, Dr Nkhoma proceeds to explain how this affects those with compromised immune systems, such as people who are living with The AIDS virus or use tobacco, for example. He tells us that the natural progression of TB means that bacteria can get inside a person and infect them. That the individual can either get rid of the infection or contain it within the body system for a long time or go on to develop the acute disease. He goes on to explain more about the negative role immune system lowering conditions, including HIV and AIDS, cancer and diabetes, that stay with a person for life, play in increasing the likelihood of the infection progressing to active or recurrent disease.

"If you are of normal immunity, the proportion of those who will keep a disease, contain it or get rid of it will be much larger. When you have low immunity, however, for example through HIV infection, diabetes, cancer, smoking or other immune-reducing events then your probability of progressing to active disease after getting infected by bacteria increases substantially.

"When you are HIV-infected, you remain in that state for life. The difference between these other immune lowering conditions compared to HIV is that it depends on how much damage you have incurred in your lungs where smoking is concerned. If you stop smoking before your lung systems are destroyed, you limit the chances and extent to which the TB bacteria can take advantage and proliferate.

Dr Nkhoma then details the extent to which TB is one of the leading causes of death worldwide and the most single infectious agent, ranking even above HIV/AIDS. We know that there has been an analysis of the impact of these described conditions and

also hepatitis. The world has now woken up to the fact that there are more people today living with hepatitis than those with HIV, TB or malaria, Dr Nkhoma emphasises.

"The analysis from 2000-2015 looked at the extent to which these conditions resulted in deaths and it shows that since 2000, the mortality rate of those with HIV was going up significantly but by 2005, when antiretroviral therapies (ART) became widely available, that trend has declined significantly to such an extent that by 2015, hepatitis has taken over HIV, malaria and TB. And viral hepatitis is the one infection among these conditions whose mortality rate has continued to increase.

"So, the one other communicable condition that the world should now be taking notice of is viral hepatitis. After this comes TB and by 2015 it was killing close to 1.3 million people. In the same year, hepatitis resulted in the death of 1.5 million people. HIV had slightly declined to around 1.2 million people. The high mortality burden from HIV/AIDS and TB were still there, but the significant observation to make is that the decline in mortality from HIV/AIDS is much deeper and faster, while that from TB is steady but slower compared to that from HIV/AIDS. By the time we get to 2030, if we leave things the way they are then HIV deaths will be much lower and TB deaths will be higher than HIV deaths alone."

Dr Nkhoma adds that in the African region, the early increase in deaths of people with TB was because of the immune debilitating effect of HIV/AIDS, but this has hugely been and continues to be positively impacted on by the successful rollout of ART's in communities. However, the mortality rate of those with TB that does not come from HIV co-infection requires continued aggressive actions to find and treat active TB cases in a timely manner. He then details his thoughts on malaria, where analysis shows that around 500,000 people died from this condition by 2015, which is a decline from the earlier figure of 800,000.

In closing, Dr Nkhoma underscores that while the region of Africa has made progress when it comes to reducing the burden of communicable diseases slowly but steadily, Africa is still one of the regions in the world with the highest TB rates. Also, the region of Africa in light of the Sustainable Development Goals needs to end the TB endemic by 2030, a point which Dr Nkhoma leaves us with as he makes a call for action to improve diagnosis and treatment.

"One aspect of this is Universal Health Coverage (UHC), concerns prevention, diagnosis, treatment, care and social protection. In terms of coverage, for TB, to date, only 50% of our population is being covered. Therefore, we need to take urgent and major steps to find the cases we are not finding or covering. We need to put in place a programme for social protection to ensure that everybody will have access to these services without being impoverished in any way.

"To find new cases, we must adopt the most sensitive technology to identify TB. We have been using microscopy but this only identifies approximately 50% of existing cases, even in the best of hands. However, we are now moving toward molecular tests in the African region which picks up around 88-90% of TB cases. As a region, we must move away from the old methods of diagnosis and wholeheartedly adopt the molecular tests for the sake of the whole population.

"One last message is that funding for TB is still far below what we need. We are still relying heavily on donor funding and recent documentation shows that in the African region, only 26% of what we need is being funded as part of the government's domestic budget for TB. 34% of what we need is provided by international bodies. So that leaves us with 41% of the required budget still not funded and that is a huge gap to be filled if we are to achieve the SDG targets.

"All the core services and treatments for TB we need should be borne by our country's domestic budget and in terms of Universal Health Coverage (UHC), nobody should have to pay for these services." ■

Dr Wilfred Alexander Chalamira Nkhoma,
MPH; PhD; FRSPH (UK)
Medical Officer Case Management AIDS,
TB and Hepatitis (HTH)
WHO Office for the Africa Region
Inter-Country Support Team for Eastern & Southern Africa
(IST/ESA)
Tel: +263 772 155 629 632
nkhomaW@who.int
www.afro.who.int

SACIDS Foundation for One Health

www.sacids.org