



## Towards the development of infectious disease early warning systems in Tanzania

### Key messages

- As infectious diseases threat increases in Tanzania, effective ways of predicting outbreaks and planning for outbreak responses becomes increasingly important.
- A number of researches on epidemic prone diseases including emerging infectious diseases have been carried out in Tanzania; evidences can provide useful information that can guide planning processes and priority settings
- However, such information is not available for planning disease surveillance and outbreak management
- It is recommended that the government of Tanzania to consider establishing a national platform for infectious disease epidemics early warning system.

### Executive summary

Management of infectious disease outbreaks entails collection of data that informs response plans including outbreak preparedness. Accessing and using information on infectious diseases exposure status, the affected population and disease carriers in routine surveillance for prediction of outbreaks and setting priorities can be challenging. However, for many years, research work has been generating useful information on infectious diseases exposure status and burdens, geographic dispersion, priori risks of several diseases of outbreak potential. We propose the government to set mechanisms that can enhance utilization such evidences to enhance outbreak preparedness and response. Such a mechanism could include establishing a national platform for infectious disease early warning systems. The

proposed platform aims at adding value to the existing human surveillance systems for infectious diseases in developing early warning systems. The goal is to reduce the number of deaths, illnesses and impact from infectious diseases outbreaks. The platform will enhance the capacities to cope with and build resilience to infectious disease epidemics through improvement of disease surveillance, climate monitoring, data analysis, interpretation, forecasting and dissemination for use in national decision-making. The platform will enhance appropriate utilisation of routine epidemiological data, research evidence, climate forecasting, mathematical modelling and computational skills to form the backbone early warning systems for epidemic-prone diseases in Tanzania.

### The Problem

In recent year, the world has witnessed eruptions of newly discovered diseases, re-emerging of old diseases, disease epidemics spreading to new areas, diseases which become important through human technologies and diseases spreading from animals to humans. Two thirds of all new emerging infectious diseases have originated in animals, and are direct result of globalization and anthropogenic activities. Among these are viral diseases including Ebola, SARS, MERS, Marburg, Avian influenza, Lujo virus, Dengue, Chikungunya and Zika. During the last decade, Tanzania has experienced and still is fighting a number of outbreaks, including cholera, measles, Rift Valley fever, dengue, Chikungunya and anthrax (Mweya et al., 2014, 2015; Sindato et al., 2014, 205; Mboera et al., 2016; Vairo et al., 2016).

Evidence based outbreak preparedness provides ground to streamline and concentrate

our efforts towards diseases that have been documented to circulate. Among other things, Outbreak preparedness entails prediction of possible epidemics with regards to the possible location of involvement, population at risk, extent of the outbreak and its spread. Therefore, for any effective outbreak preparedness plan, information on priori risks is crucial in setting priorities for a robust outbreak management and response. Research findings for decades have displayed a mapping of exposure pattern and burden of infectious diseases that have a potential to cause outbreaks in the community. Studies in Tanzania have indicated endemic circulation of a number of viruses in many parts of the country in both humans and animal. For instance, a recent study in Mbeya revealed exposure to yellow fever virus indicating circulation of the virus in Mbeya region (NIMR unpublished report). Other diseases of outbreak potential that research has demonstrated their presence in the country include Rift Valley fever, influenza, Dengue, Chikungunya, West Nile Fever and Zika (Sindato et al., 2014; D'Acremont et al. 2014, Weller et al. 2014, Vairo et al. 2012; Mirambo et al., 2016). Such information is crucial for epidemic preparedness and response.

Already in Malaysia, a disease-outbreak predicting application using machine-learning models to predict dengue prior to an epidemic has been developed (Husin et al., 2006). Not only is this prediction model valuable for disease prevention and saving disability adjusted life years, but also saves valuable financial resources due to the heavy costs and resource utilization associated with poorly predicted management techniques and costs to the health system when an outbreak happens. Lowe et al., (2013) recently has developed a probabilistic risk forecasts early warning model for dengue in Brazil. Using environmental and health data covering the past 60 years, EcoHealth Alliance scientists created the first-ever, global disease hotspots map that identified at-risk regions, to help predict and prevent the next pandemic crisis (EcoHealth Alliance, 2015). WHO is strengthening existing surveillance systems for infectious diseases, developing early warning systems based on the above concepts and techniques. Countries where

an early warning system have been established by 2002 are Egypt, Iraq, Jordan and Serbia. Preventing epidemics relies on activating the right counter-measures, and scientists are now trying to find out how better the use of forecasting techniques can help. These emerging technologies are likely to become a powerful means of helping us collect more accurate and timely information, which in turn can lead to more effective preventive measures and improved public health practice. The techniques are expected to allow decision makers to identify areas where the model predicts with certainty a particular risk category, to effectively target limited resources to those districts most at risk for a given season.

Despite the available scientific evidence on the presence and distribution of disease causing pathogens in human and animal populations, most endeavours in low and middle-income countries are focused on reactive efforts once an outbreak has emerged with lives lost and precious time wasted. It is time that Tanzania develops and operationalise a national platform for infectious disease epidemics early warning system by enhancing capacity in disease surveillance, climate monitoring, data analysis, interpretation, forecasting and dissemination for use in national decision-making. Early warning systems and scientific prediction provide tools to combat and get ahead of pandemics to ensure that humans, animals and the environment continue to have a healthy relationship.

### **Policy options**

In Tanzania, there are a few reports of functional early warning systems for epidemics. During the early 2000s, paper-based malaria early warning systems were developed for malaria epidemic prone districts, and were found to be useful in predicting malaria outbreaks (Mboera et al., 2005). Currently, there are remarkable advances in science and technology, providing access to a wide range of early warnings. Global computer models and satellite images, regional centres of expertise, national meteorological offices and other government agencies, local field reports and community observations all allow us to better understand what is happening, and what is likely to happen. A warning of an impending epidemic can help relevant authorities and communities

prepare and take immediate actions to reduce morbidities and mortalities.

As infectious disease threat increases in Tanzania, enhancing ways of detecting and predicting outbreaks becomes increasingly important. The imminent need of an effective outbreak preparedness and response plan is underscored by the recent epidemics dominated in parts West, Central and East African neighbouring countries. Responding to epidemics first requires identifying the areas with high potential for disease emergence. Using a variety of scientific and environmental factors, hotspot maps of areas likely to have an emerging disease outbreak can timely be identified. Already, an initiative called PREDICT, the most comprehensive zoonotic surveillance and virus identification program, has shown that early epidemic prediction is possible. PREDICT outposts have been stationed in over 20 countries with the goal of building in-country capacity to identify zoonotic disease threats, and put in place systems to address and prevent those diseases.

This policy recommendation aims at making full use of epidemiological and other scientific information in preparing the community to take action before a health emergency happens. The goal is to reduce the number of deaths, illnesses and impact from infectious diseases outbreaks. Specifically, the platform will strengthen the national capacities to cope with and build resilience to infectious disease epidemics by enhancing capacity in disease surveillance, climate monitoring, data analysis, interpretation, forecasting and dissemination for use in national decision-making. Upon establishment, the national platform will have the following roles:

- 1) Increase significantly the utilization of disease surveillance and research data for disease control and prevention
- 2) Improve our knowledge on the occurrence of epidemics in Tanzania
- 3) Improve the community and national capacity to timely respond to infectious disease outbreaks in Tanzania

- 4) Add value to the existing human surveillance systems for infectious diseases of human and animal in developing early warning systems
- 5) Scale up actions with vulnerable communities in health promotion, disease prevention and risk reduction.

### **Implementation considerations**

In the current scenario, surveillance and research epidemiological statistics are rarely used to detect and confirm an epidemic requiring action. The recommended platform will be composed of scientists (including veterinarians, epidemiologists, ecologists, mathematical modelling experts, software developers), disease control programme experts, planners and decision makers. The platform will employ a 'One Health' approach to our programs that brings people, animals and the environment together under the same health umbrella. A network of scientists conducting research in emerging diseases of outbreak potential in the country will be established to synthesise research on epidemic-prone disease that have been conducted each year and channel the information to the national platform. This activity can be coordinated from the National Institute for Medical Research. The platform will form a team of experts in the area who will analyse such data including prediction of the possible future outbreaks and formulate the recommendations for the national Emergency Operation Centre for relevant actions.

### **Competing interests**

The authors declare that they have no competing interests.

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### About the National Institute for Medical Research

The National Institute for Medical Research is a public health research institution established by the Act of Parliament No. 23 of 1979 with the mandate to carry out, co-ordinate, monitor and control health research in the United Republic of Tanzania.

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