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Assessment of the Status of Telehealth and its Potential as a Surveillance and Information Sharing Tool for HIV and AIDS, TB and Malaria in the SADC Region

ORIGINAL IN
ENGLISH

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A Technical Review Group composed of senior government officials in the area of surveillance of communicable diseases, and representatives of partner organisations from the international community, as well as from the private sector, reviewed drafts and made recommendations to facilitate finalisation and subsequent approval of the document at the joint SADC Ministerial Meeting of Ministers of Health and Ministers responsible for HIV and AIDS.

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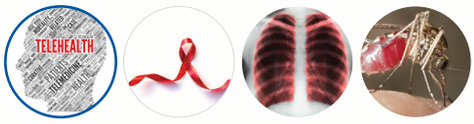
For more Information

Directorate of Social and Human Development
And Special Programs
SADC Secretariat
Private Bag 0095
Gaborone, Botswana
Tel (267) 395 1863
Fax (267) 397 2848
Email: registry@sadc.int
Website: www.sadc.int



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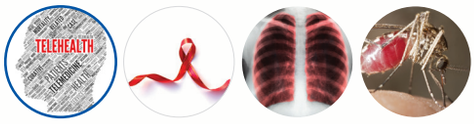
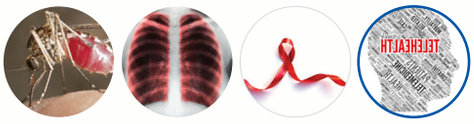


ACRONYMS AND ABBREVIATIONS

ADF	African Development Fund
ADSL	Asymmetric Digital Subscriber Line
AfDB	African Development Bank
AIDS	Acquired Immunodeficiency Syndrome
ART	Antiretroviral therapy
CDC	Centres for Communicable Disease Prevention and Control (U.S.)
DHIS	District Health Information System
DRC	Democratic Republic of Congo
DSL	Digital Subscriber Loop
GIS	Geographical Information Systems
GSM	Global System for Mobile communications
HIV	Human Immunodeficiency Virus
HMN	Health Metrics Network
ICT	Information and Communication Technology
IDSR	Integrated Disease Surveillance and Response
IHR	International Health Regulations
ISDN	Integrated Services Digital Network
LAN	Local Area Network
MDR-TB	Multi Drug Resistant TB
M&E	Monitoring and Evaluation
NGO	Nongovernmental Organisation
NHIS	National Health Information System
NHLS	National Health Laboratory Service
NICD	National Institute for Communicable Diseases
NICI	National Information and Communication Infrastructure
SADC	Southern African Development Community
SICI	Sectoral Information and Communication Infrastructure
SMS	Short Message Service
SNRL	Supra-National Reference Laboratory
TB	Tuberculosis
TNDS	Telehealth Network for Disease Surveillance
UNECA	United Nations Economic Commission for Africa
UNFPA	United Nations Population Fund
UPS	Uninterruptible Power Supply
UNICEF	United Nations Children Fund
VSAT	Very Small Aperture Terminal
WAN	Wide Area Network
WHO	World Health Organization
WiFi	Trademark of the Wi-Fi Alliance
XDR-TB	Extensively Drug Resistant Tuberculosis



DEFINITION OF TERMS

Information and communication technology (ICT), as a whole, and the Internet, in particular, have ushered in an era of great opportunities in public health and clinical care. It is therefore important to define some of the key terms that pertain to the use of ICT in the health sector: telemedicine, Telehealth, eHealth and mHealth.

Telemedicine: The delivery of health care services, where distance is a critical factor, by health care professionals using ICT for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers. All this occurs in the interest of advancing the health of individuals and their communities (1). An example would be when clinicians obtain second opinions about patients or consult specialists at remote locations about a case, either by telephone, email or through the Internet.

Telehealth: The use of electronic ICT to support long-distance clinical health care, patient and professional health-related education, public health and health administration (2). Telehealth is therefore broader than telemedicine, in that it also includes public health interventions. When health professionals use information and communication tools to interact with other health professionals or with the public in order to support public health interventions, they are engaged in Telehealth activities.

eHealth: A systematic review of published materials carried out in 2005 identified 51 unique definitions for eHealth (3). They ranged from broad and all-embracing statements to concise descriptions, for example:

“eHealth is the use of information and communication technologies (ICT) for health”—WHO, Global Observatory for eHealth, 2005 (4).

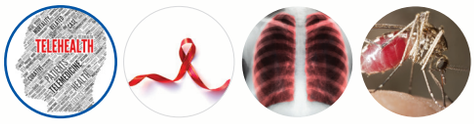
“eHealth is an emerging field of medical informatics, referring to the organisation and delivery of health services and information using the Internet and related technologies. In a broader sense, the term characterises not only a technical development, but also a new way of working, an attitude, and a commitment for networked, global thinking to improve health care locally, regionally, and worldwide by using information and communication technology”—adapted from Eysenbach (2001) (5).

For the purposes of this report, the term eHealth is used as defined by WHO above, i.e. the use of ICT for health. Examples of eHealth include the development, maintenance and use of electronic medical records; the use of the Internet for health purposes; and the employment of decision support tools for diagnosis and/or case management.

mHealth: The term mHealth is a contraction of “mobile eHealth”. It broadly encompasses health related uses of mobile telecommunication and multimedia technologies in health service delivery and public health systems (6).

It is therefore eHealth, with the further requirement that the dominant technology platform is a hand-held device, such as a mobile phone (cell phone), personal digital assistant, or more recent devices such as smart phones and tablet computers. The most common examples of mHealth for the purposes of this document are the use of mobile phones for (a) data collection and transfer directly into databases; (b) professional communications among health workers; and (c) consultation of websites with smart phones and tablet computers. If any of the above activities, are performed with the use of mobile devices, then the activities are considered to be mHealth.

This report deals with Telehealth, but also makes reference to the other terms, especially eHealth, since the latter is the most encompassing of these terms. Appropriate policy and strategy, infrastructure and human resources for eHealth generally would cover telemedicine, Telehealth, and mHealth, as well.



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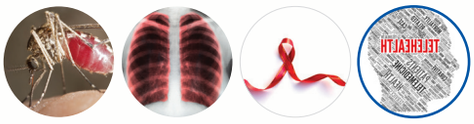


EXECUTIVE SUMMARY

Introduction and background

Health challenges in the Southern African Development Community (SADC) continue to undermine the attainment of a SADC vision that includes healthy citizens in all its Member States. Among these health challenges are the communicable diseases, Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS), Tuberculosis (TB) and Malaria.

In order to help address these challenges, the SADC Protocol on Health was invoked to produce an agreement on the harmonisation of disease surveillance throughout the SADC region. To support such harmonisation, and in accordance with the e-SADC framework, the SADC Secretariat has undertaken a study to assess the status of Telehealth and its potential as a surveillance and information-sharing tool for HIV and AIDS, TB and Malaria. A further objective of the study was to propose a Telehealth system that could serve as a platform for strengthening all aspects of surveillance of these diseases, as well as national referral hospitals and reference laboratories in the region.

A study was commissioned to assess the feasibility of establishing a Telehealth system as a surveillance tool for communicable diseases including HIV and AIDS, Malaria and TB in the SADC region. Its objectives were to:

- Assess the extent to which Telehealth is currently being used as a surveillance and information sharing tool in SADC Member States;
- Explore the potential and feasibility of Telehealth as a surveillance and information tool in the SADC region;
- Assess the state of telecommunications infrastructure in terms of its readiness to accommodate Telehealth services;
- Identify the equipment currently available in Member States that can be used for the establishment of a fully functional Telehealth system for strengthening active disease surveillance, for on-time reporting and information sharing among Member States, as well as for a referral hospital and a reference laboratory.

Methodology

A cross-sectional survey was carried out in 14 SADC Member States. Sampling was purposive, rather than random, with specific key informants being targeted. Data collection was conducted between November 2010 and April 2011 through semi-structured in-depth interviews with key informants at Ministry of Health headquarters, national referral hospitals, and national referral laboratories in 14 SADC Member States.

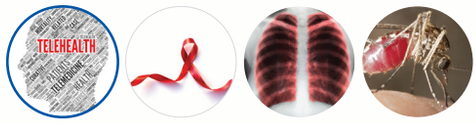
The qualitative approach was deemed suitable because it allowed for unstructured or semi-structured exploration and understanding of the research topic. Two structured questionnaires with closed questions were used to collect quantitative data.

Findings

The assessment found challenges in a number of areas, including:

- Policy and the regulatory environment for eHealth in Member States;
- Health information systems, with the dominant capture mode being paper, and data entry and computerisation at national level and/or sub-national level;
- Human and financial resources, which were not inadequate for the expected results; and
- Current use and available equipment and infrastructure for Telehealth in Member States.

The study also identified strengths that could form the foundation for a regional Telehealth Network for Disease Surveillance (TNDS) to meet the needs of Member States and the SADC Secretariat.



Six examples of good practice were highlighted for possible adaption and replication in other Member States. These were:

- National eHealth Strategy and Master Plan in Mauritius;
- The ICT unit in the Ministry of Health in Zambia;
- The Automated Laboratory Alert System in South Africa;
- Public-private partnership for eHealth in Botswana;
- SMS for Life in Tanzania; and
- Cell-Life in South Africa.

Conclusions

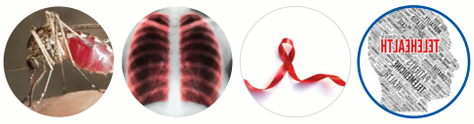
Member States can be grouped into three broad categories in terms of their use of Telehealth for disease surveillance and early warning, referrals among hospitals and exchanges between laboratories and reference laboratories. Mauritius and South Africa were found to be well-advanced, with policies and systems in place, and sufficient technical infrastructure to support ICT-mediated services.

Nine other Member States (namely Angola, Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mozambique, Namibia, Seychelles and Tanzania) were at various stages of building technical and human capacity for eHealth and implementing projects and programmes to improve health services through the use of ICT. In Swaziland, Zambia and Zimbabwe, ICT infrastructure in the health sector was in its early stages and needed to be strengthened to provide basic eHealth services. Also identified were also broader resource issues that could impact on a Telehealth system, such as policy and strategy, infrastructure, human and financial resources, and support for the transition of Member States from one category to another.

Recommendations

Informed by the findings, the following recommendations are made:

- National policies and strategies, and appropriate regulatory environments for eHealth should be developed in SADC Member States;
- All Member States should ensure that disease surveillance programmes, referral hospitals and reference laboratories have reliable ICT infrastructure, appropriate equipment, tailored training programmes and adequate technical service units for maintenance, as well as the means for capturing and sharing epidemiological and other data electronically;
- SADC should promote the development of an interconnected system—a TNDS—with three sub-networks focusing on disease surveillance, referral hospitals and reference laboratories. Proper management and support from the SADC Secretariat will be the key for successfully implementation;
- While SADC Secretariat should provide financial support to Member States, the latter should also tap into existing eGovernment programmes for additional resources. Programmes should include an eGovernment Interoperability Framework to facilitate data sharing among government ministries;
- Ministries of Health should promote the use of their email domains by staff and should take necessary steps to improve availability and quality of this service to all professional health workers. All SADC Member States should draw up plans for migrating their systems towards electronic data capture, transfer, processing, sharing and storage, with adequate backup in the event of failure in primary storage units;
- All SADC Member States should promote professional networking and sharing of information and knowledge, both nationally and regionally; and
- SADC should support all Member States in their efforts to implement these recommendations.



1. INTRODUCTION

1.1 Context

SADC is a regional economic community of 15 Member States: Angola, Botswana, DRC, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, United Republic of Tanzania, Zambia and Zimbabwe.

SADC's vision is that of a regional community that ensures the economic well-being, improvement in the standards of living and quality of life, freedom, social justice, peace and security for the people of Southern Africa.

Article 21 of the Treaty of SADC provides for areas of cooperation, while Article 22 provides for the conclusion of protocols in the areas of cooperation (7). In accordance with these provisions, Member States have agreed on a policy framework document, adopted by the SADC Council in September 1998, which forms the basis for cooperation under the SADC Protocol on Health (8). It recognises that close cooperation in the area of health is essential for the effective control of communicable diseases, non-communicable diseases and for addressing common health concerns in the region.

The health challenges in the region continue to undermine the attainment of the SADC vision. This is largely due to the heavy burdens of disease in the region, particularly of HIV and AIDS, TB and Malaria.

The HIV and AIDS pandemic, by virtue of its magnitude, is the single greatest developmental and public health concern in the SADC region, and the SADC Protocal on Health is intended to address this challange especially. The protocal is a binding agreement that obliges Member states to submit annual progress reports, as directed by SADC Head of states and Government.

In 2010, SADC Member States approved a harmonized surveillance framework for HIV and AIDS, TB and Malaria with core indicators for each of the three diseases. To strengthen this effort, the SADC Secretariat is implementing an initiative to support the control of these communicable diseases. One of the components of the initiative is "Upgrading the Surveillance Systems for HIV and AIDS, TB and Malaria in the SADC Region".

Member States also recognize the existence of gaps in laboratory service provision and have given approval for the strengthening of laboratory systems. The capacity of Member States to provide laboratory services is not uniform, with certain Member States having comparative advantages over others in certain areas of service provision.

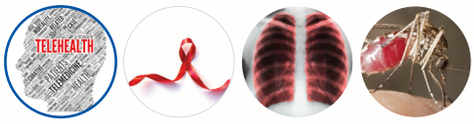
Acknowledging these variations, Member States wish to develop mutually beneficial mechanisms for sharing resources, including the establishment of supra-national laboratories. At a meeting in November 2010, SADC Health Ministers agreed that the following Member States should serve as hosts of supra-national regional laboratories (SNRL) and regional centres of excellence (RCEs):

SNRL—HIV and AIDS: Botswana, South Africa and Zimbabwe;
SNRL—TB: Botswana and Zambia;
RCE—Quality assurance: South Africa and Zimbabwe; and
RCE—Human resources: South Africa

These will be well-equipped laboratories that will perform various tests related to communicable diseases, including HIV and AIDS, TB and Malaria as well as drug-resistant forms of TB. The SADC region also recognizes that patient referral occurs from one country to the other currently occurs in an ad hoc manner. This results in a lack of strategic coordination of information due to the absence of a regulatory framework on patient referrals across the region. There are also delays in the referral of patients among Member States for treatment at super speciality hospitals. Finally, there are challenges in the joint management of patients, as well as in the sharing of patient information.

1.2 Problem statement

A key component of the effort to combat communicable diseases in the SADC region is strengthening the coordination and harmonisation of regional communicable outbreak-prone disease surveillance systems and establishing Telehealth-based coordination, and monitoring and evaluation (M&E) of interventions.



There are currently limited ways for Member States to share information on the status, epidemiological trends, patterns of spread and outcomes parameter levels (such as incidence, prevalence, morbidity, co-infections, drug-resistant patterns and mortality rates) of HIV and AIDS, TB and Malaria. For example, disease-specific regional reports are shared at regional meetings and SADC Member States report data on these communicable diseases to the SADC Secretariat. However, the reporting occurs only once a year and there are challenges associated with more regular reporting, and with data quality and validation mechanisms.

The SADC Secretariat therefore commissioned a consultancy to help strengthen existing efforts to manage and control communicable diseases. One component of the initiative focused on the need to develop a Telehealth system for SADC Member States as a timely surveillance and information-sharing tool capable of providing information for action to prevent disease transmission, morbidity and premature deaths.

1.3 Literature review

There is indexed literature (in leading journals) that deals with Telehealth in developing and developed countries. Relatively little of the currently available literature deals directly with the surveillance aspects, however. Examination of the relevant literature shows some examples of Telehealth surveillance for communicable diseases, including HIV, TB and Malaria in the SADC region. These, together with experiences from other regions, are discussed in three separate sub-sections on disease surveillance, delivery of health services (including referral services), and laboratory work.

1.3.1 Disease surveillance

Most Telehealth advances have emerged in developed countries. A literature review of emerging infectious threats to public health in Ontario, Canada, led to a proposal for ways to integrate a telephone-based health information service and emergency department triage with a first-line real-time, 24-hour syndrome surveillance system. The automated system was seen as a new option for detecting disease outbreaks at first contact with the healthcare system, and was deemed beneficial in detecting and monitoring disease outbreaks such as influenza, Norwalk, West Nile virus, Escherichia coli 0157 and severe acute respiratory syndrome (7).

Irrespective of where an infected patient first interacts with health care services, subsequent Telehealth action to ensure surveillance remains the same. The organisation and nature of such Telehealth activity forms the cornerstone of Telehealth for disease surveillance. An important examination that is integral to communicable disease surveillance is the chest X-ray. A method as simple as a digital photo of the film, and its transmission as an email attachment has been shown to be as effective as directly viewing of the film (8, 9). However, 75% of the world's population has no direct access to medical imaging. To bridge this gap, a system was developed. It uses a mobile phone, which transmits an image from a remote send site, but with the novel feature that any processing takes place at the receiving site, where the necessary hardware and software are located (10). This has great potential for the SADC region, where mobile telephony is well established.

The worldwide web is a potentially powerful tool for disease surveillance. A web-based notification system, such as the one available in South Africa, provides a single, consistent approach to the collection and provision of health data using a standards-based, integrated system. It is expected to improve the accuracy, quality, timeliness and coordination of surveillance information for notifiable medical conditions (11).

Although new to the SADC region, the Internet has been used in this way in Nepal since 2004, one of several examples where the Internet is being used for health-related activities—ranging from patient/doctor consultation through database services, to the management of epidemics (12).

Similarly, in India, online telemedicine has helped to avert an epidemic (13). Daily reporting of in-patient and outpatient cases at a hospital near a grand religious fair in north India revealed a surge of diarrhoea cases among pilgrims. Vibrio cholerae was isolated through microbial examination of stools samples referred to the Sanjay Gandhi Post Graduate Institute of Medical Sciences. This information was relayed online to the main hospital at the fair and to the health authorities, which took strict and prompt measures to improve hygiene, thereby averting a likely outbreak of cholera. Even in the absence of web services, a telephone-based Telehealth service for data collection from public health laboratories and triage for medical emergencies can supply valuable data and can function as an important part of a SADC surveillance Telehealth system. Its value has already been demonstrated in the surveillance of communicable diseases in Canada (14).

Despite the link between human health and animal health, veterinary Telehealth has not attracted much attention from researchers in the health community. Many deaths occur each year from well-known and preventable animal diseases that are transmitted to humans, especially in developing countries, due to a lack of early detection and preventive measures.

Thinyane et al. described a case study exploring the use of mobile phones for rapid reporting of zoonotic diseases in South Africa (15). They outlined a short message service (SMS) based mobile service to enable community members to report suspected cases of diseases. The service aimed to increase the number and density of traditional reporting sources to facilitate near real-time reporting and consequently achieve more rapid response to zoonoses outbreaks.

In addition to Telehealth applications, ICT-related technologies have been used successfully in disease surveillance. Moss et al., recently identified environmental risk factors for Malaria transmission using remote sensing technologies to guide Malaria control interventions in a region of declining burden of Malaria. Satellite images were used to construct a sampling frame for the random selection of households enrolled in prospective longitudinal and cross-sectional surveys of Malaria parasitaemia in Southern Province, Zambia. A total of 768 individuals from 128 randomly selected households were enrolled over 21 months, of whom 117 (15.2%) tested positive in Malaria rapid diagnostic tests. Individuals residing within 3.75 km of a third-order stream were at increased risk of Malaria, while households at elevations above the baseline elevation for the region were at decreasing risk of having RDT-positive residents. Based on the spatial risk map, targeting households in the top 80th percentile of Malaria risk would require that Malaria control interventions be directed at only 24% of households. The authors concluded that remote sensing technologies can be used to target Malaria control interventions in a region of declining Malaria transmission, thus enabling more efficient use of resources for Malaria elimination (16).

In a similar effort, Kelly et al., examined modern approaches to geographical reconnaissance operations using personal digital assistants to define the spatial distribution of target populations to support contemporary Malaria elimination interventions in the Solomon Islands and Vanuatu (17). They found that geographical reconnaissance, when implemented using modern techniques, provided an effective and efficient operational tool for rapidly defining the spatial distribution of target populations in designated Malaria elimination zones. The data generated could be used for the strategic implementation and scaling-up of priority interventions, and was essential for establishing future surveillance using spatial decision support systems.

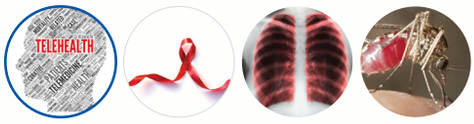
1.3.2 Delivery of health services

In Zambia, as in some other SADC Member States, medical expertise, equipment and information resources are concentrated largely in the major cities. Chanda et al. (2010) did a descriptive study of the Zambian National Telehealth Steering Committee, based on the literature, news reports and personal experience. The study sought to outline the benefits of Telehealth initiatives in ameliorating some of the problems caused by an inequitable distribution of health care expertise, equipment and knowledge resources (18).

The authors concluded that librarians at the University of Zambia Medical Library, who have a history of making knowledge available and who have been involved in the national Telehealth strategy, could provide outreach services to hospitals and health facilities throughout the country. The learning would be of use in building capacity and would help referral hospitals and supranational laboratories provide information to other hospitals and laboratories in SADC Member States that lack such highly skilled workers. Other authors have approached the subject of education and training using other Internet modalities. Kiviat et al. employed Internet-based communication to provide training and education to health care providers in HIV treatment programmes in resource-limited areas.

They used Internet-based conferencing technology to conduct interactive case-based training conferences with health care professionals in Africa, Asia and the Caribbean. They concluded that the online programme might be a model for other efforts to provide education to health care providers treating HIV-infected patients in the developing world (19). Such a system could be a component of a referral system through which specialists in hospitals receiving referrals gradually could transfer skills and build capacity in referring hospitals.

Another feature of health services in SADC Member States (and in other developing countries) is that access in rural areas usually involves considerable transport costs. Although community health workers and volunteers from local villages have been integral in bridging the patient-physician gap, large amounts of time are spent in transit between hospitals and villages. Mahmud, Rodriguez and Nesbit reported the results of a retrospective mobile health (mHealth) pilot at St. Gabriel's Hospital in Malawi, which was designed to eliminate much of the travel by communicating via text messages.



A group of 75 community health workers were supplied with cell phones and trained to use the network, including for patient adherence reporting, appointment reminders and physician queries. At the end of the pilot, the hospital had saved approximately 2,048 hours of worker time and US$ 2,750 (US$ 3,000 in fuel savings minus US$ 250 in operational costs), and it had doubled the capacity of the TB treatment programme. The authors concluded that mHealth interventions could provide cost-effective solutions to communication barriers in rural health care in developing countries (20). It remains to be seen whether such experiences can be applied to higher levels of the healthcare pyramid to eliminate unnecessary referrals among hospitals through improved ICT.

1.3.3 Laboratory services

With respect to laboratory services, traditional, non-Telehealth, communicable disease epidemic recognition has many disadvantages. Disease surveillance and early detection (early warning systems) depend on Member States' capacities to clinically detect cases, followed by laboratory confirmation. Strengthening of laboratory services among Member States has been slow and requires competent, compliant medical technologists and pathologists, virologists (for HIV), microbiologists (for TB) and parasitologists (for Malaria). A statistical and/or computer analysis of appropriate data is quicker and more reliable. Availability of computing equipment and networking for timely dissemination of results to a requesting site and for sharing information, are therefore key aspects of an assessment of Telehealth for laboratory services.

Since laboratory medicine is often image-based, Telehealth can improve its practice. The Africa Telepathology project had been providing dermatology support to local providers in Africa (including Botswana, Malawi, Lesotho and Swaziland) by using store-and-forward teledermatology and teledermatopathology since 2007 (see http://africa.telederm.org). However, the project experienced severe limitations, including the number and quality of images that were available to consultants, and a reliance on referring providers (who sometimes lacked dermatopathology training) to produce representative photomicrographs. Fischer et al. installed a Zeiss Mirax Live RT system at the National Health Laboratory in Gaborone, Botswana in 2009. With up to four slides placed on the motorised microscope, the consultant could remotely control stage position, focus and magnification. The system showed that telepathology is feasible in resource-limited settings, and its routine use could improve clinical care and education (21). The replicability of the experience, however, depended on socioeconomic and health contexts and adaptation to local settings.

Sometimes even low-cost options for microscopy are not available. For example, use of an affordable strategy to address the challenge of implementing the low-cost microscopic observation drug susceptibility assay, a non-proprietary test that delivers rapid and accurate diagnosis of TB and multidrug-resistant TB in isolated settings is avoided because of unavailability of qualified staff. Zimic et al. used mobile phones in Peru, first to transmit images captured by an inverted microscope to a remote site where trained personnel performed pattern recognition. It was then used to receive the resulting output of the analysis. The authors concluded that such a system could be used to train laboratory personnel through distance learning, resolution of equivocal appearances and quality assurance (22).

In many instances, there is a need to harness the power of the collective through collaboration. Suhanic et al. examined collaborative diagnostics for laboratory medicine microbiology protocols, where free and open communication and networking applications are used to link distributed collaborators for reciprocal assistance in organising and interpreting digital diagnostic data. They also examined commodity engineering, which leverages globally available consumer electronics and open-source informatics applications, to build generic open systems that measure information in ways that are substantially equivalent to more complex proprietary systems. Routine microscopic examination of Giemsa and fluorescently stained blood smears for diagnosing Malaria was used as an example to validate the model (23).

The authors showed that open telemicroscopy workstation design and use-processes can address clinical microbiology infrastructure deficits in an economically sound and sustainable manner. It can boost capacity to deal with comprehensive measurement of disease and care outcomes in individuals and groups in a distributed and collaborative fashion. The workstation enabled local control over the creation and use of diagnostic data, while allowing for remote collaborative support of diagnostic data interpretation and tracking. It can therefore enable regional pooling of Malaria disease information and the development of open, participatory and adaptable laboratory medicine practices.

In general, the key to successful telepathology is the quality of the work of the experts, who should be selected, based on their diagnostic expertise and their commitment to the provision of telepathology services, as shown in a comparative analysis of two telepathology servers in Europe (24). The service was shown to be suitable for requesting pathologist from both developing and developed countries.

1.3.4 Overarching considerations

The literature on a number of other issues of relevance to Telehealth for disease surveillance is discussed below.

ICT readiness in Africa
There is clear demand for eHealth in the SADC region as shown, for example, in the surveys of the WHO Global Observatory for eHealth in 2005 and 2009-10, which reported plans for eHealth and mHealth activities (www.who.int/goe). Demand is also evident in the work of the ICT Science and Technology Division of the United Nations Economic Commission for Africa (UNECA) in developing national ICT policies in SADC Member States (http://www.uneca.org/aisi/nici/), and the African Union Commission's Pan-Africa e-Network for Telemedicine and Tele-education project with nodes in 8 SADC Member States (www.panafricaenetwork.com).

The World Bank has identified various reasons why African economies (including their health sectors) are ready for ICT (see, for example, www.etransformafrica.org):

- The diffusion of ICT into virtually all aspects of life has changed the world in many ways;
- eHealth presents an opportunity to build the health system of the future rather than overhaul the health systems of the past;
- ICT infrastructure is being introduced at a rapid pace in African countries. After the Connect Africa Summit in Kigali in October 2007, commitments reached USD 55 billion;
- eHealth has gained attention at the international level, including in larger ICT components of donor programmes. An example is the Rockefeller Foundation's Bellagio summer series on eHealth, titled "Making the eHealth Connection", which focused on the Global South with special attention to Africa (www.ehealth-connection.org).

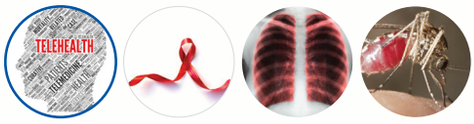
Capacity building
Since the publication of the World Health Report 2006 (25), challenges surrounding human resources for health and what ICT could do to alleviate health worker shortages in Africa have taken centre-stage in the eLearning literature.

Mars (2010) carried out a literature review on telemedicine for clinical practice and education of health workers as a possible means of addressing some of the health problems of Africa. He cited a number of factors that impede the use of telemedicine in sub-Saharan Africa. They include poverty, shortages of human resources, very limited infrastructure, lack of connectivity, high connectivity costs, lack of capacity development and various policy issues. The author concluded that initiatives to develop capacity through tele-education appear to have been well received and are more successful than clinical telemedicine. However, there is a need to raise awareness of telemedicine if it is to assist in developing eHealth capacity in Africa (26).

Technology and connectivity
The technology used for developing country Telehealth varies. The Internet allows a variety of effective communications modalities among its users. The major approaches for providing Internet connectivity are: traditional terrestrial systems which leverage telephone lines to provide Asymmetric Digital Subscriber Line (ADSL) services; fibre optic cabling for high bandwidth connections; satellite services; and mobile telephony services. All four modalities are relevant to the SADC region.

Policy and legal and regulatory environment
Harmonised policies are important for a regionally successful undertaking. The relevant regional policy is the e-SADC policy, which was adopted in May 2010. This is in line with high-level agreements and declarations that identify a role for technology in support of health and regional development, such as the Declaration and Treaty of SADC. In Article 5, the document states that one of its objectives shall be to "promote the development, transfer and mastery of technology".

Legal aspects are important, especially because cross-border Telehealth services are an essential part of a regional Telehealth activity. Appropriate attention should be paid to standards, security, and privacy of the information that is collected and transmitted. Responsibility should be pre-assigned to anticipate and eliminate possible problems, such as connectivity issues. The legal and regulatory environment should be examined for possible conflicts between existing relevant laws of the Member States. For example, Member States might have different regulations for obtaining information from patients or for governing permissible medications and their dispensing.



eHealth toolkit

A recent study looked at developing an eHealth toolkit for antiretroviral treatment (ART) in South Africa (27). This could be of great use, since it could incorporate other aspects of eHealth through a comprehensive tool to support ART. Experience from beyond the SADC region is of potential help for ensuring the success of efforts to develop Telehealth for disease surveillance in the SADC region, as the literature review has shown. Other domains of eHealth could leverage investments in Telehealth for disease surveillance to support health systems strengthening in general, and for specific aspects such as the health workforce (including decision support systems to aid clinicians in diagnosis and treatment); electronic health records to improve patient management and information sharing; eLearning for continuing professional development of health workers; eLearning for health promotion; health information systems; and stewardship of the health system.

1.3 Rationale

One of the objectives of the SADC Protocol on Health is to promote cooperation between Member States in order to coordinate regional efforts on epidemic preparedness, mapping, prevention, control and, where possible, on the eradication of communicable and non-communicable diseases (Article 3). The Protocol also states that Member States should share information on health systems research and surveillance, and should cooperate and assist each other in its dissemination (Article 6). Article 7 mentions the need for the SADC region to develop Telehealth applications. The development of a Telehealth system for purposes of diseases surveillance and information sharing therefore is a regional imperative.

The harmonised surveillance framework that has been developed will require Member States to report data annually on core indicators. However, reporting on communicable diseases should occur more frequently—quarterly or even more frequently. This is especially important for complications such as multidrug-resistant TB (MDR-TB) and extensively drug-resistant (XDR-TB) that require tracking and reporting on a more regular basis. Such reporting schedules demand a fast and efficient mechanism for reporting and sharing information. This is why a Telehealth system is being proposed to facilitate effective real-time sharing of surveillance information.

The interest in assessing the potential of a Telehealth system stems from the fact that a harmonised surveillance framework with clearly defined indicators for diseases of HIV and AIDS, TB and Malaria has been developed. Efforts are underway to strengthen the surveillance system for these diseases in the region. Data that will be generated by that system would be crucial for informing the design and management of programmes on communicable diseases. The usefulness of the data could be enhanced by a fully functional Telehealth system that allows quick and efficient sharing of the data among Member States and between Member States and the SADC Secretariat.

Thus, the co-existence of the harmonised surveillance framework and a Telehealth system could enhance the effective management of communicable diseases in the SADC region. Currently, there are limited mechanisms for prompt sharing of M&E data among Member States and between them and the SADC Secretariat. This makes it important to investigate the feasibility and potential for a mechanism for quick and efficient information sharing in the SADC region. Article 9 of the SADC Protocol on Health states that “State Parties shall share information related to outbreaks and epidemics of communicable diseases within the region and work together in epidemic control and management.” Telehealth can be used in an “early warning system” for early detection of Malaria outbreaks and Malaria epidemics. A Telehealth system becomes handy in such situations and the region may capitalise on the speed with which information is transmitted. Because of the efficiency associated with Telehealth in sharing information, it is important for such system to act as a surveillance tool also for other communicable and non-communicable diseases in addition to HIV and AIDS, TB and Malaria.

The SADC Secretariat therefore has sought the services of the Consultant to assess the status and potential use of a Telehealth system in the region for the surveillance of communicable diseases including HIV and AIDS, TB and Malaria. The Consultant was also tasked with assessing the extent to which Telehealth is currently being used in the region, the equipment that is required for establishing a fully functional Telehealth system, and the cost of equipment needs. Given that the shortage of skilled personnel is a major challenge in the SADC region, the Consultant was also tasked with assessing the availability of skilled personnel to support a Telehealth system in Member States.

In addition, the assessment would examine the feasibility of a Telehealth system that would support existing surveillance systems, and the potential of such a network with a view to improving:

- Harmonisation of surveillance systems;
- National reference laboratories; and
- National referral hospitals.

2. AIMS AND OBJECTIVES

The aim of the study was to assess the feasibility of establishing a Telehealth system as a surveillance tool for communicable diseases (including HIV and AIDS, Malaria and TB) in the SADC region. The objectives of the assessment were to:

- Assess the extent to which Telehealth is currently being used as a surveillance and information-sharing tool in SADC Member States;
- Explore the potential and feasibility of Telehealth as a surveillance and information tool in the SADC region;
- Assess the state of telecommunications infrastructure in terms of its readiness to accommodate Telehealth services; and
- Identify the equipment currently available in Member States that can be used for the establishment of a fully functional Telehealth system for strengthening active disease surveillance, for on-time reporting and information sharing among Member States, as well as for a referral hospital and a reference laboratory.

In the specific context of this assessment, the health facility is replaced by the Ministry of Health and the "health services" provider becomes the specific disease surveillance programme. The "community", meanwhile, comprises the SADC Secretariat and the various diseases surveillance programmes in other SADC Member States. The model involves a slightly different set of actors when Telehealth is used for referral hospitals. In that case, the health facility is replaced by the sending and receiving hospitals that are involved in the referral, and the referred patients constitute the "community".

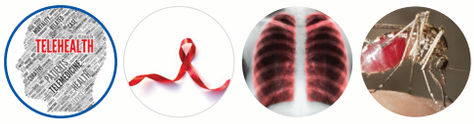
A similar modification is necessary when Telehealth is used for supporting reference laboratories. The health facility then refers to the reference laboratory, the "health service provider" becomes the providers of laboratory services at the sending and receiving ends, and the "community" comprises the referring laboratory. For each area of application (disease surveillance and early warning, referrals among hospitals, and exchanges between laboratories) Telehealth functionality was separated into three levels—Basic (Level I), Intermediate (Level II), and Advanced (Level III). The minimum requirements that are discussed later refer to Level I functionality.

3. METHODOLOGY

3.1 Study design

A cross-sectional survey was carried out in 14 SADC Member States to assess how each Member States was using Telehealth, and to determine the potential of Telehealth to serve as a disease surveillance and information sharing tool for communicable diseases (including HIV and AIDS, TB and Malaria) in the region. Data collection was done between November 2010 and April 2011 through semi-structured in-depth interviews with key informants at the Ministry of Health headquarters, national referral hospitals, and national referral laboratories in all 14 SADC Member States.

The qualitative approach was deemed to be suitable because it allowed for an unstructured or semi-structured exploration and understanding of the subject being researched. Interviewers took notes during the interviews to provide additional data to guide the analysis. All interviews were conducted with key informants in each country during the six-month period. The interview notes were transcribed by a trained qualitative researcher and coded to identify emerging themes from the data. The transcribed data was organised and coded manually, and then analysed using thematic analysis. Thematic analysis was used as an analysis framework because it allowed the team to derive meaning while remaining systematic (28).



This allowed the researchers to identify and analyse patterns of meaning in the dataset and to explore both descriptive aspects of the data and also present differences, common themes and unexpected themes in the data (29). Using this method, the team was able to indicate the most important themes.

3.2 Sampling

The sampling technique used was purposive selection. The rationale for using qualitative methods is different from that used in quantitative methods. Hence, the sample was purposive rather than random. The aim was to reach individuals who could provide rich data for the assessment (30). The sampling was therefore done by identifying and selecting individuals who shared certain characteristics or experiences that were of interest to the assessment (31).

Key informants were selected based on their roles in policy- and decision-making at national and sub-national levels, and on their positions (Permanent Secretaries and Directors General), responsibilities and knowledge about different control communicable diseases programmes, particularly HIV and AIDS, TB and Malaria programmes.

Also interviewed were other staff and support personnel who were involved in data collection, data management and information sharing. They were selected based primarily on their positions in the programmes of interest. They included programme data managers, information and communication technology experts and managers, national tertiary hospital managers, and national and supra-national reference laboratory managers. Other staff that worked with the above officials were selected for that reason, and were interviewed if they were available during the country visits.

A detailed list of key informants interviewed is provided as Annex 1.

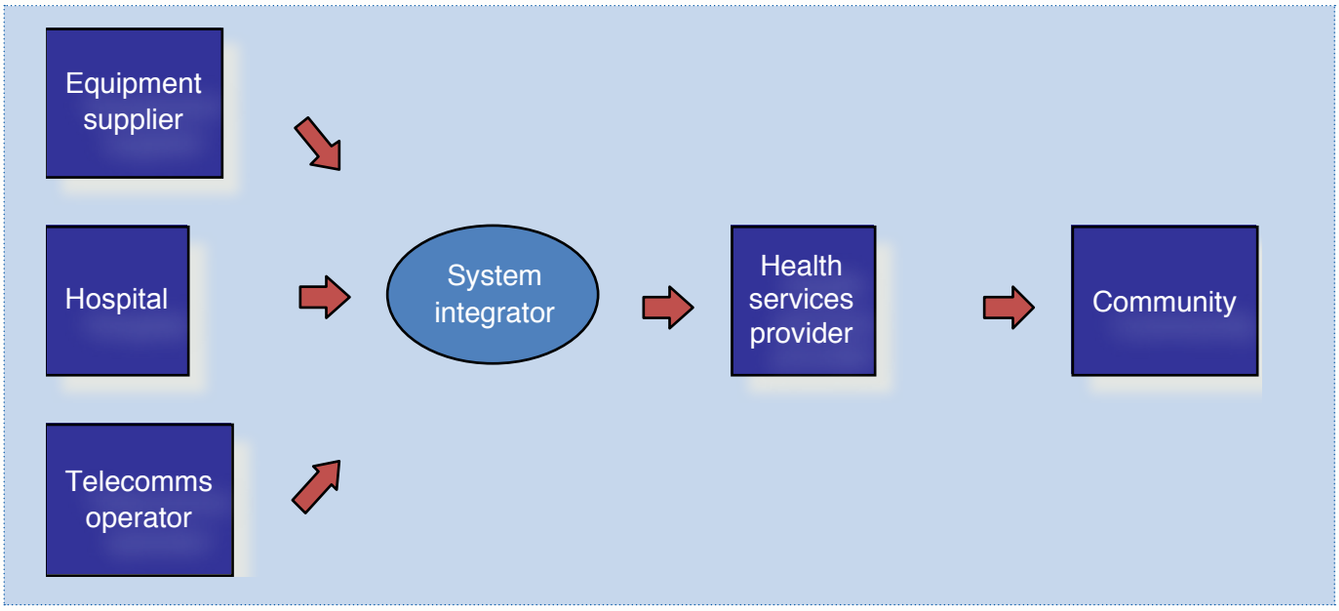
3.3 Sample size

In each Member State, a target of 10 key informants from the various categories was set in order to collect necessary information to review the burden of disease of HIV and AIDS, TB and Malaria, to assess how each Member State used Telehealth, and to determine the potential of the Telehealth to serve as a disease surveillance and information-sharing tool.

3.4 Basics of a Telehealth system

A typical Telehealth installation consists of the main elements shown in Figure 1. A system integrator brings together products from an equipment supplier and communications infrastructure from a telecommunications operator to support processes that are carried out in a health facility. Health care providers then use this integrated package in the facility to deliver services to an intended beneficiary or community.

Figure 1: A basic Telehealth system



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3.4.1 Equipment

The equipment that is needed depends on the specific Telehealth application. Basic disease surveillance mainly requires database equipment, including:

- A server, preferably with a backup server;
- A laptop for local access to the server;
- A Local Area Network (LAN) or Wide Area Network (WAN);
- A printer and an Uninterruptible Power Supply (UPS) to safeguard data in the case of loss of mains electric power.

The LAN or WAN is generally not specified in terms of its individual components, but as a package of router and associated cabling and accessories that function together. For basic Telehealth in referral hospitals a computer (distinct from a server) is needed. It should be connected to the Internet and, preferably, should have a UPS for electrical power backup. More sophisticated Telehealth applications would require:

- An integrated telemedicine station with appropriate probes and built-in data transmission components, either on a roll cart or simply in the form of a portable dispatch case;
- Fixed video camera and associated monitors for video conferencing; and
- A picture archiving and communication system if medical imaging studies are to be stored and shared in digital format.

Similarly, for basic Telehealth laboratory applications a computer is the main item of equipment. If electrical power is unreliable, the computer should be connected to a UPS. Remote telepathology and other sophisticated applications would require specialised equipment for controlling and viewing slides at a distance.

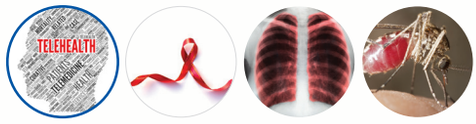
3.4.2 Telecommunications infrastructure

The main item of telecommunications infrastructure is Internet connectivity. For even basic applications for diseases surveillance, referral hospitals, reference laboratories and information sharing purposes, a broadband connection of at least 128k bps is necessary. Higher bandwidths would allow faster service and generally greater satisfaction by the users.

Connectivity could be provided by any of three main platforms:

- ADSL using a plain old telephone system or fibre optic cables;
- Satellite services via a Very Small Aperture Terminal (VSAT); or
- Wireless connectivity from a mobile telephony provider.

The connectivity infrastructure comes with its own hardaware (appropriate modem, cables, connectors) and software. In addition to these elements, which focus on the technology, there are other institutional elements that contribute to the full functionality of a Telehealth system for disease surveillance. They are issues of policy, the health information system, human resources, and financial resources.



3.4.3 Health information systems

The health information system constitutes the "brain" of health systems, and affects all aspects of those systems. A Telehealth system for disease surveillance would need to feed up-to-date information into the health information system.

3.4.4 Policy

eHealth policies and strategies, and policies on ICT in general, as well as the regulatory environment that governs the implementation of such policies and strategies, are crucial to the success of a Telehealth system.

3.4.5 Human resources

In addition to the physical capital represented by infrastracture and equipment, human resources are indispensable for the proper implementation of a Telehealth system. Trained users of the system and maintenance know-how to keep the system running are two of the key dimensions of the human resources component of a Telehealth system.

3.4.6 Financial resources

Financial resources are needed to acquire the elements of a Telehealth system and to operate and maintain that system. The assessment therefore sought to examine the availability of the necessary items for basic Telehealth as a tool for harmonising the disease surveillance systems and for supporting referral hospitals and reference laboratories in SADC Member States.

3.5 Data collection tools

Two structured questionnaires with closed questions were used to collect quantitative data:

1. The adapted WHO health metrics network tool allowed for assessing and comparing the status of HIV and AIDS, TB and Malaria surveillance systems, the national health information systems and the M&E systems of each Member State (Annex 2).

2. A structured questionnaire, which addressed two aspects of the assignment:

- Assessment of the current status of Telehealth application and ICT software solutions for data gathering, data management and data and information flow specific to the individual Member States;

- Assessment of the potential for each Member State to successfully use Telehealth to improve the health outcomes of its citizens (Annex 3A).

The following aspects were addressed:

- How Telehealth was used as a disease surveillance and an information-sharing tool in and between Member States;
- What aspects of health were addressed by Telehealth;
- What equipment was currently available for Telehealth;
- How the Telehealth system was to be linked to existing health information systems, such as geographical information systems (GIS), integrated disease surveillance and response (IDSR) systems, web-based disease notification systems, etc.;
- How the current ICT systems were working in each country;
- Member States laboratory capacity and referral mechanisms; and
- Tertiary hospitals referral systems in place.

To determine Member States' potential to implement Telehealth for surveillance, a strengths, weaknesses, opportunities and threats analysis was conducted to determine endogenous and internally controllable factors in the Ministries of Health for implementing an efficient Telehealth system.

The exercise also helped assess threats and opportunities that could impact on the implementation of the Telehealth disease surveillance and health information sharing between the SADC Member States. This approach ensured that there was alignment with the regional collaboration efforts and with the following specific Articles of the SADC Protocol on Health (contents of the specific articles appear in Annex 4):

- Article 6 on health system research and surveillance;
- Article 7 on health information systems;
- Article 9 on communicable disease control;
- Article 10 on HIV and AIDS and sexually transmitted diseases;
- Article 11on Malaria control;
- Article 12 on TB control;
- Article 25 on emergency health services and disaster management;
- Article 26 on health laboratory services;
- Article 27 on health technology and equipment; and
- Article 28 on referral systems.

3.6 Inclusion and exclusion criteria

Apart from Madagascar, all SADC Member States were eligible for inclusion. Respondents were the most relevant and knowledgeable officials from the Ministry of Health and Ministry of Information Communication and Technology at national headquarters. All officials at sub-national levels were excluded from the assessment.

3.7 Limitations

Despite prior arrangements for meetings, made through the designated country SADC contact person, it was a challenge to secure meetings with some relevant officials in some Member States. In such cases, meetings were either rescheduled or the respondents were replaced with other officials. These second-choice interviewees might not have been as knowledgeable as the key informants originally targeted. This could have compromised the quality of the information that was gathered. However, occasions that brought the study team together with representatives of Member States (such as the consensus workshop) provided opportunities to complete and correct any such shortcomings. In some countries, laboratories (SNRL and NRL) and tertiary hospital functions fall outside the Ministry of Health mandate. This made it difficult to arrange official meetings with their staff, thus making the data collection more difficult to complete.

4. RESULTS AND FINDINGS

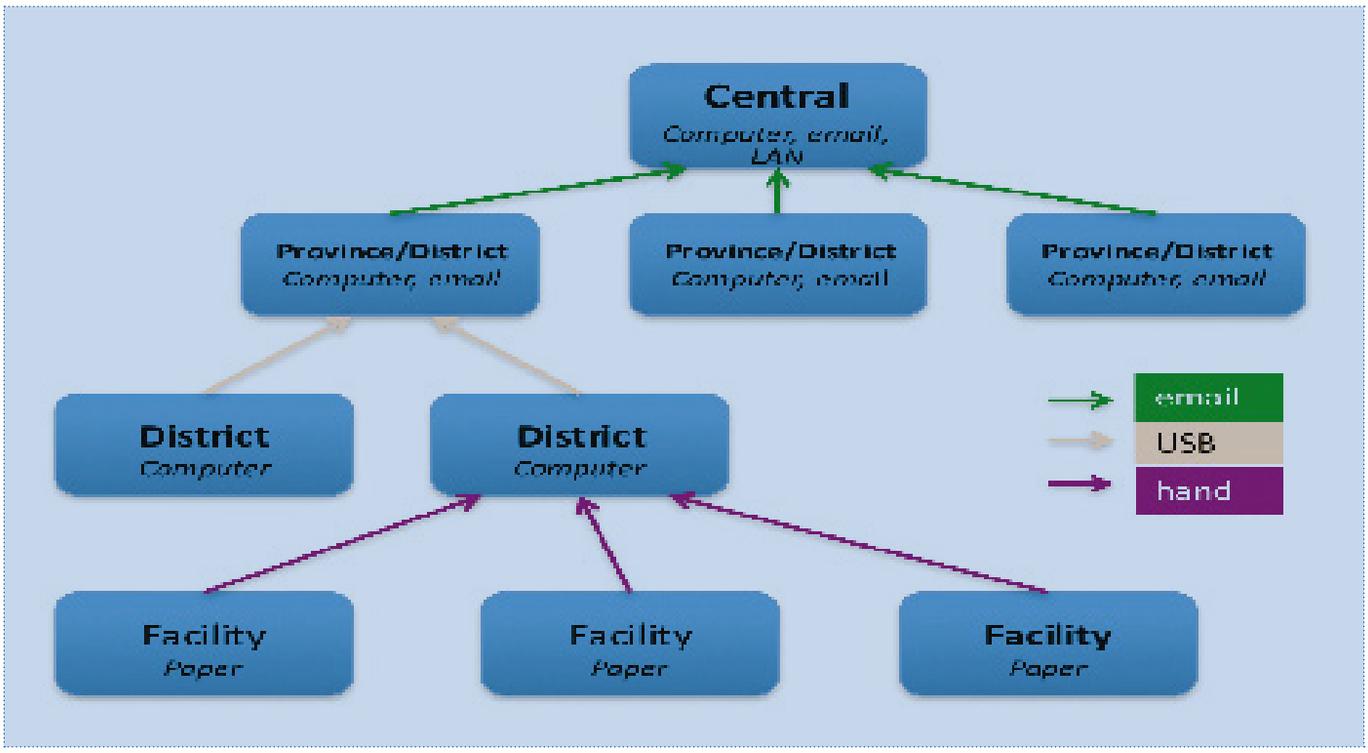
4.1 General findings (policy, legal and regulatory environment, human and financial resources)

In all SADC Member States, the Ministries of Health are the central Government organs that set broad policy directions. Each ministry has a number of Departments that are led by Programme Managers and Directors who report directly to the Permanent Secretary or to a Chief Director or Deputy Permanent Secretary.

Countries are subdivided administratively into provinces and/or districts. The health system follows this administrative structure, except that health districts are further divided into health areas. The designations “province”, district” “health areas” differ from country to country, but the three or four tiers (from health area to national) are fairly uniform. The only exceptions in the SADC region are Botswana, Mauritius, Seychelles and Swaziland, which do not have provinces. At district level there usually is a first-level hospital, while provinces have secondary hospitals and, in some, cases tertiary facilities. Hospitals usually fall under the Department that is responsible for health services.

Every SADC Member State has a national health information system. The data capture and transmission system is shown schematically in Figure 2. At facility level, the dominant capture mode is on paper and transmission is by hand delivery to the district. At district level, computers are used for data entry but there generally is no connectivity. Electronic data therefore are shared on flash drives (USB key) to the provincial level. Provinces have computers and connectivity, and can send data by email to the central level (when Internet service is available) or by USB (when the service is down). The widespread use of flash drives, while providing a convenient means of transferring data when connectivity is down or where there is no connectivity, has created a significant challenge as computer viruses and worms are now easily transmitted among machines and sometimes lead to infection of entire networks.

Figure 2: Dominant data capture and transmission modes



The exception to this model is Mauritius, where data are captured directly onto computers.

4.1.1 Policy and regulatory environment

Table 1 summarises the eHealth policy and strategy situation in SADC Member States. There are published national eHealth strategies in Mauritius and Tanzania. Other countries appear to have no such formal publications. In some cases, Member States need to formalise an existing draft eHealth policy.

Table 1: Summary of eHealth policy and strategy situations in SADC Member States

Country	Policy	Policy	Strategy		
	ICT (NICI*)	eHealth	eHealth	Use of strategy	Countrywide use
Angola	In process	No	No	N/A	N/A
Botswana	Yes	Yes	No	N/A	N/A
DRC	In process	No	No	N/A	N/A
Lesotho	Yes	No	No	N/A	N/A
Malawi	Yes	No	No	N/A	N/A
Mauritius	Yes	Yes	Yes	Yes	Yes
Mozambique	Yes	No	No	N/A	N/A
Namibia	Yes	No	No	N/A	N/A
Seychelles	Yes	Yes	No	N/A	N/A
South Africa	Yes	In process	In process	N/A	N/A
Swaziland	Yes	No	No	N/A	N/A
Tanzania	Yes	Yes	Yes	No	No
Zambia	Yes	No	No	N/A	N/A
Zimbabwe	Yes	No	No	N/A	N/A

** National Information and Communication Infrastructure*

Box 1: Good practice—national eHealth strategy and master plan in Mauritius

The need for a conducive policy and regulatory environment for a flourishing Telehealth network cannot be over-emphasised. Mauritius has an ICT policy, an eHealth strategy and a Master Plan for implementation of ICT in the health sector. The country is currently implementing its Master Plan, with some 27 coordinated eHealth projects. This includes a functional Telehealth system that is used by clinicians and health sector managers and administrators. Some slight improvements can be made, but none require assistance from the SADC Secretariat.

The absence of published policies and strategies on eHealth in all but two SADC Member States (see Table 1) points to a regulatory gap that needs to be filled in those SADC Member States that do not have an updated regulatory environment in place. Even where regulations are in place, they need to keep pace with the fast growth and diffusion of ICT into SADC Member States.[1]

4.1.2 Human resources

Budget provisions within Ministries of Health generally are insufficient for employing ICT staff in all facilities in countries. Even when posts are available at provincial and district levels, they are not easy to fill; more attractive work and service conditions are often available for ICT experts in the capitals and outside the health sector, especially in the private non-health sector.

Box 2: Good practice—ICT unit in Ministry of Health in Zambia

The Ministry of Health in Zambia recently created an ICT department. The staff is salaried, with career prospects within the Ministry. In 12 months, they have been responsible for repairing all hardware and software problems in the Ministry and in facilities across the country. The ICT department is performing well.

Faced with the challenge of insufficient human resources, SADC Member States have had to devise coping mechanisms. They have tended to use four methods to ensure that technical support is available in health ministries and health facilities:

- Government budgets;
- Donor programmes;
- Internships for students in technical degree programmes at local tertiary institutions; and
- Outsourcing to the private sector.

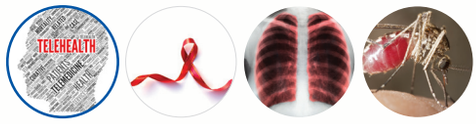
The government funding approach includes the secondment of staff from central services, as practiced in Botswana and Namibia. In Malawi, by contrast, ICT staff is deployed into health facilities via the nongovernmental organisation (NGO) sector. Donors fund these staff positions, and the personnel therefore are not accountable directly to the Ministry. However, the NGOs do work transparently with the Ministry, and share they knowledge and data.

Capacity to use and maintain ICT systems in Ministries of Health is weak and ICT units in those ministries either do not exist or require strengthening. Despite general recognition of the added value of ICT to the health sector, resources are not sufficient to attract and maintain a corps of technical staff that can develop and maintain the ICT services for the health system.

4.1.3 Financial resources

Financial resources for the health sector as a whole are limited. As a result, SADC Member States depend to varying degrees on funding support from donors and partners. Resources for ICT in health are even more limited, despite the recognition that ICT is essential for improving health services. In most countries there are a number of disparate vertical systems that are being implemented with donor funding. Although health is included in all eGovernment initiatives, they entail lengthy processes, and Ministries of Health often find themselves competing with other ministries for any financial resources for acquisition and installation of ICT that come through these channels.

1 *In South Africa, for example, the Health Professionals Council of South Africa in June 2011 took issue with the practice of telemedicine, since the law forbids the provision of medical services to patients without a physical examination. This would affect how Telehealth is used in the context of inter-hospital referrals, one of three main focus areas in this assessment.*



4.2 Current use of Telehealth for surveillance

All SADC Member States have passive disease surveillance systems. For notifiable diseases, the captured and reported data (as shown schematically in Figure 2) are collected and analysed. In the case alerts or specific concerns, feedback occurs through the IDSR weekly bulletin and phone calls. Early warning is based on these weekly reports and on pre-set thresholds for each disease, depending on the population that is covered by the data. Meteorological data can also be used to trigger alerts. When rainfall exceeds a certain threshold the number of seasonal Malaria cases is likely to increase. Botswana, for example, uses this as part of its early warning system for seasonal Malaria.

Mobile phone data capture has been identified as a potentially powerful technology to alleviate a major weakness in the early warning system, namely delays in data reporting due to communication challenges. Mobile phone usage in data collection is widespread in SADC Member States.

4.2.1 Minimum requirements for Telehealth

Table 3 presents an overarching picture of the current situation with respect to the minimum requirements for using Telehealth tools and systems in disease surveillance. The four conditions deemed necessary for Telehealth are:

- Adequate connectivity;
- Equipment to enable access to the Internet;
- Available capacity of staff to use the technology, and
- Staff to maintain the system so as to reduce breakdowns and increase availability of the entire system.

In addition to these basic requirements, access to a local email server greatly facilitates improved networking and sharing of information and knowledge. The availability of a Ministry of Health domain name for email addresses of staff is therefore included as a facilitating requirement. These requirements extend across all components—Ministries of Health and associated disease programmes, referral hospitals and reference laboratories.

Based on these requirements, Table 2 shows that 11 of 14 SADC Member States have the basic minimum availability of server and connectivity for Telehealth, while three (Swaziland, Zambia and Zimbabwe) do not. However, every SADC Member State has the potential for Telehealth in disease surveillance, since adequacy of the available server and Internet connectivity are the main challenges in the three Member States that do not yet meet the minimum requirements. Zambia does not have a server, while Swaziland and Zimbabwe have servers with below-par specifications (see Table 3). While Zambia has adequate Internet bandwidth of 1 Mbps available, Swaziland and Zimbabwe have limited speeds at 64 kbps and 128 K bps, respectively.

Table 2: Minimum requirements for Telehealth in SADC Member States: Ministries of Health

Country	Server & Connectivity		Capacity to use [c]	Ministry of Health email [d]	Equipment [e]	ICT staff [f]
	Connected [a]	Adequate [b]				
Angola	Yes	Yes	Yes	Yes	Yes	Access
Botswana	Yes	Yes	Yes	Yes	Yes	Access
DRC	Yes	Yes	Yes	Yes	Yes	In-house
Lesotho	Yes	Yes	Yes	Yes	Yes	In-house
Malawi	Yes	Yes	Yes	Yes	Yes	Access
Mauritius	Yes	Yes	Yes	Yes	Yes	In-house
Mozambique	Yes	Yes	Yes	Yes	Yes	In-house
Namibia	Yes	Yes	Yes	Yes	Yes	In-house
Seychelles	Yes	Yes	Yes	Yes	Yes	N/A
South Africa	Yes	Yes	Yes	Yes	Yes	In-house
Swaziland	Yes	No	Yes	Yes	Yes	In-house
Tanzania	Yes	Yes	Yes	Yes	Yes	Access
Zambia	Yes	No server	Yes	Yes	Yes	In-house
Zimbabwe	Yes	No	Yes	Yes	Yes	In-house

Key:

(a) Broadband connection—connection speed above dial-up speeds
(b) As reported by staff
(c) Data Manager can use network to send data
(d) Ministry of Health has a functional domain name with email addresses for employees
(e) A server is available to the Data Manager at the Ministry of Health; either a central server or programme server, or one for a group of programmes
(f) Ministry of Health has access to ICT expertise for maintenance of system

Table 3: Server and Internet connectivity for disease surveillance in SADC Member States

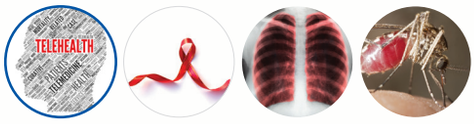
Server for disease surveillance and Internet connectivity				
Country	**Server adequate** [(a)]	**Backup type**	**Internet connectivity type**	**Internet speed**
Angola	Yes	External drive	ADSL—fibre optic	2-4 Mbps
Botswana	Yes	None	ADSL—fibre optic	1Gbps
DRC	Yes	External drive	VSAT	Average
Lesotho	Yes	None	DSL	No data
Malawi	Yes	None	Yes	No data
Mauritius	Yes	Slave disk, tapes	DSL	256K bps—4 Mbps
Mozambique	Yes	None	Wireless	2 Mbps
Namibia	Yes	None	DSL—leased line	2 Mbps
Seychelles	Yes	Backup server	DSL	1 Mbps
South Africa	Yes	Tape	Fibre optic, WiMax, DSL leased line	14 Mbps
Swaziland	No	None	DSL	64Kbps
Tanzania	Yes	Backup server	DSL	1 Mbps
Zambia	No server	External drive	DSL—fibre optic	1 Mbps
Zimbabwe	No	No	VSAT and DSL	128 KBPS

Key: (a) Meets or exceeds specifications shown in Annex 6

The situation with HIV and AIDS surveillance mirrors the situation with regard to the Ministry of Health, since national HIV and AIDS control programmes tend to be well-funded and sometimes even share their resources with central ministries.

Table 4: Minimum requirements for Telehealth in SADC Member States: HIV and AIDS surveillance

Country	**Connectivity**		**Capacity to use** [(c)]	**Ministry of Health email** [(d)]	**Equipment** [(e)]	**ICT staff** [(f)]
	Connected [(a)]	**Adequate** [(b)]				
Angola	Yes	Yes	Yes	Yes	Yes	Access
Botswana	Yes	Yes	Yes	Yes	Yes	Access
DRC	Yes	Yes	Yes	Yes	Yes	In-house
Lesotho	Yes	Yes	Yes	Yes	Yes	In-house
Malawi	Yes	Yes	Yes	Yes	Yes	From NGO
Mauritius	Yes	Yes	Yes	Yes	Yes	In-house
Mozambique	Yes	Yes	Yes	Yes	Yes	Access
Namibia	Yes	Yes	Yes	Yes	Yes	Access
Seychelles	Yes	Yes	Yes	Yes	Yes	In-house
South Africa	Yes	Yes	Yes	Yes	Yes	In-house
Swaziland	Yes	No	Yes	Yes	Yes	In-house
Tanzania	Yes	Yes	Yes	Yes	Yes	Access
Zambia	Yes	No server	Yes	Yes	Yes	In-house
Zimbabwe	Yes	No	Yes	Yes	Yes	Access



Key:
(a) Broadband connection—connection speed above dial-up speeds
(b) As reported by staff
(c) Data Manager can use network to send data
(d) Programme has access to a Ministry of Health domain name with email addresses for programme employees
(e) A server is available to the programme; either a central server or programme server or one for a group of programmes
(f) The HIV and AIDS programme has access to ICT expertise for maintenance of system

TB programmes also mirror the situation in Ministries of Health. All SADC Member States have programmes for TB, since the disease is closely linked to the HIV and AIDS epidemic. The situation with Telehealth in TB programmes is depicted in Table 5. Here, too, 11 of 14 SADC Member States have the minimum requirements for Telehealth.

Table 5: Minimum requirements for Telehealth in SADC Member States: TB surveillance

Country	Connectivity		Capacity to use [c]	Ministry of Health email [d]	Equipment [e]	ICT staff [f]
	Connected [a]	Adequate [b]				
Angola	Yes	No	Yes	Yes	Yes	Access
Botswana	Yes	Yes	Yes	Yes	Yes	Access
DRC	Yes	No	Yes	Yes	Yes	In-house
Lesotho	Yes	Yes	Yes	Yes	Yes	In-house
Malawi	Yes	No	Yes	Yes	Yes	From NGO
Mauritius	Yes	Yes	Yes	Yes	Yes	In-house
Mozambique	Yes	No	Yes	Yes	Yes	Access
Namibia	Yes	Yes	Yes	Yes	Yes	Access
Seychelles	Yes	Yes	Yes	Yes	Yes	In-house
South Africa	Yes	Yes	Yes	Yes	Yes	In-house
Swaziland	Yes	No	Yes	Yes	Yes	In-house
Tanzania	Yes	No	Yes	Yes	Yes	Access
Zambia	Yes	No	Yes	Yes	Yes	In-house
Zimbabwe	Yes	No	Yes	Yes	Yes	Access

Key:
(a) Broadband connection—connection speed above dial-up speeds
(b) As reported by staff
(c) Data Manager can use network to send data
(d) Programme has access to a Ministry of Health domain name with email addresses for programme employees
(e) A server is available to the programme; either a central server or programme server or one for a group of programmes
(f) The TB programme has access to ICT expertise, including from the Ministry of Health, for maintenance of system

With regard to Malaria surveillance programmes, three SADC Member States are free of Malaria (Lesotho, Mauritius and Seychelles) and are concerned only with imported Malaria. Botswana and South Africa are heading towards the same status, thanks to their Malaria elimination efforts. In terms of Telehealth, the existing Malaria programmes fare slightly less well than the HIV and AIDS programmes: eight of the programmes currently have adequate connectivity.

Table 6: Minimum requirements for Telehealth in SADC Member States: Malaria surveillance

Country	Connectivity		Capacity to use [c]	Ministry of Health email [d]	Equipment [e]	ICT staff [f]
	Connected [a]	Adequate [b]				
Angola	Yes	Yes	Yes	Yes	Yes	Access
Botswana	Yes	Yes	Yes	Yes	Yes	Access
DRC	Yes	Yes	Yes	Yes	Yes	In-house
Lesotho	N/A	N/A	N/A	Yes	N/A	N/A
Malawi	Yes	Yes	Yes	Yes	Yes	From NGO
Mauritius	N/A	N/A	N/A	Yes	N/A	N/A
Mozambique	Yes	Yes	Yes	Yes	Yes	Access
Namibia	Yes	Yes	Yes	Yes	Yes	Access
Seychelles	N/A	N/A	N/A	Yes	N/A	N/A
South Africa	Yes	Yes	Yes	Yes	Yes	In-house
Swaziland	Yes	No	Yes	Yes	Yes	In-house
Tanzania	Yes	Yes	Yes	Yes	Yes	Access
Zambia	Yes	No server	Yes	Yes	Yes	In-house
Zimbabwe	Yes	No	Yes	Yes	Yes	Access

Key:
(a) Broadband connection—connection speed above dial-up speeds
(b) As reported by staff
(c) Data Manager can use network to send data
(d) Programme has access to a Ministry of Health domain name with email addresses for programme employees
(e) A server is available to the programme; either a central server or programme server or one for a group of programmes
(f) Malaria programme has access to ICT expertise including from the Ministry of Health, for maintenance of system.

N/A = Not applicable (No Malaria and thus no Malaria programme)

As shown inTables 3-6 and Table 9, there is an email domain name available in all SADC Member States. However, in reality some of these are not effectively used due to reliability problems. In those cases, staff back up data by using personal email addresses for official correspondence.

4.2.2 Other aspects of Telehealth in disease surveillance programmes

Similarly, the specific situation with regard to surveillance for each of the three main communicable diseases is shown in Table 7a (HIV and AIDS), 7b (TB), and 7c (Malaria). The tables focus on notification and show that paper-based notification is the dominant mode used in 12 SADC Member States for HIV and AIDS.

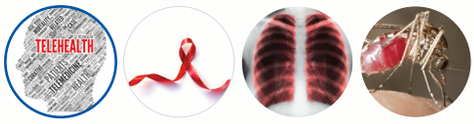


Table 7a: Telehealth in HIV and AIDS surveillance in SADC Member States

Country	Current status
Angola	Notification system
Botswana	Paper-base registry
DRC	Paper-based system
Lesotho	Paper-based system NO
Malawi	Paper-based system & piloting an electronic surveillance system
Mauritius	Paper-based system (registry), then captured electronically at point of care or ART site YES
Mozambique	Paper-based system
Namibia	Paper-based system
Seychelles	Only 9 cases in the country, paper-based
South Africa	All ART sites use paper-based system Use mobile for patient follow-up and adherence, but not integrated with TB system
Swaziland	Paper-based system, captured electronically at only 1 ART site
Tanzania	Paper-based system
Zambia	Paper-based system (registry)
Zimbabwe	Paper-based system (registry)

In the case of TB surveillance (Table 7b), ICT tools are used in the electronic TB register in Botswana, Namibia, Seychelles and South Africa. The other SADC Member States use the IDSR.

Table 7b: Telehealth in TB surveillance in SADC Member States

Country	Current use
Angola	Notification system (IDSR)
Botswana	ETR.net
DRC	DHIS
Lesotho	IDSRO
Malawi	DHIS & IDSRNO
Mauritius	IDSR case-based electronic surveillance
Mozambique	IDSR
Namibia	ETR
Seychelles	ETR
South Africa	ETR and web-based system. MDR-TB surveillance
Swaziland	IDSR
Tanzania	IDSR passive notification
Zambia	IDSR
Zimbabwe	IDSR & DHIS

Key: Electronic TB register (ETR); multidrug-resistant TB (MDR-TB); distric health information system (DHIS)

With respect to Malaria, three SADC Member States (Malawi, Mozambique and Tanzania) use active notification, while eight (Angola, Botswana, DRC, Lesotho, Namibia, South Africa, Zambia and Zimbabwe) use passive notification. Two Member States (Mauritius and Swaziland) have early warning systems and case-based surveillance in place to maintain zero reporting.

Table 7c: Telehealth in Malaria surveillance in SADC Member States

Country	Current status
Angola	Passive notification system (IDSR)
Botswana	Passive notification system (IDSR)
DRC	Passive notification system (IDSR)
Lesotho	Passive case-based surveillance system (IDSR)
Malawi	Active weekly notification system (IDSR)
Mauritius	Early warning system fully functional (IDSR)
Mozambique	Active weekly notification system (IDSR)
Namibia	Passive notification system (no IDSR)
Seychelles	Case-based
South Africa	Web-based active notification & laboratory surveillance system
Swaziland	Early warning system fully functional; uses active web-based notification system
Tanzania	Active notification system (IDSR)
Zambia	Passive notification system (IDSR)
Zimbabwe	Passive notification system (IDSR)

4.2.3 Findings on Telehealth in national reference laboratories

Table 8 shows the situation with respect to national reference laboratories. The vast majority of laboratory samples that are sent for specialised testing and verification in the SADC region go to the Medical Research Council of South Africa.

Table 8: Minimum requirements for Telehealth in SADC Member States: Reference laboratories

Country	Connectivity		Capacity to use [c]	Ministry of Health email [d]	Equipment [e]	ICT staff [f]
	Connected [a]	Adequate [b]				
Angola	Yes	No	Yes	Yes	Yes	Yes
Botswana	Yes	Yes	Yes	Yes	Yes	Yes
DRC	Yes	No	Yes	Yes	Yes	N/A
Lesotho	Yes	Yes	Yes	Yes	Yes	No
Malawi	Yes	No	Yes	Yes	Yes	Yes
Mauritius	Yes	Yes	Yes	Yes	Yes	Yes
Mozambique	Yes	No	Yes	Yes	Yes	Yes
Namibia	Yes	Yes	Yes	Yes	Yes	Yes
Seychelles	Yes	Yes	Yes	Yes	Yes	N/A
South Africa	Yes	Yes	Yes	Yes	Yes	Yes
Swaziland	Yes	No	Yes	Yes	Yes	Yes
Tanzania	Yes	No	Yes	Yes	Yes	N/A
Zambia	Yes	No	Yes	Yes	Yes	Yes
Zimbabwe	Yes	No	Yes	Yes	Yes	Yes

Key:
(a) Broadband connection—connection speed above dial-up speeds
(b) As reported by staff
(c) Data Manager can use network to send data
(d) Programme has access to a Ministry of Health domain name with email addresses for programme employees
(e) A server is available to the laboratory
(f) Laboratory has access to ICT expertise for maintenance of system

As shown in Table 9, national reference laboratories are significantly more advanced in terms of the number of Member States whose laboratories use electronic methods. Nine of the 13 SADC Member States for which data were obtained use electronic notification.

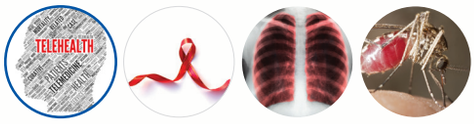


Table 9: Use of Telehealth tools for notification in reference laboratories in SADC Member States

Country	Current status—notification of results to Ministry of Health and WHO
Angola	Electronic
Botswana	Electronic
DRC	Paper
Lesotho	Paper
Malawi	Paper
Mauritius	Electronic
Mozambique	Electronic
Namibia	Electronic
Seychelles	No data
South Africa	Electronic, web-based and mobile phones
Swaziland	Electronic
Tanzania	Paper-based registry
Zambia	Electronic
Zimbabwe	Electronic

Laboratories (private and public) have an integral role in disease surveillance. They are important in confirming clinical diagnosis for index cases of notifiable medical conditions, as well as for reporting management, prevention and control of diseases outbreaks.

In South Africa, public health laboratories are part of the National Health Laboratory Service (NHLS) network, which was established in terms of the NHLS Act (Act 37 of 2000). There are 269 NHLS laboratories (23 of which can perform TB cultures across South Africa) and there are 9 provincial reference laboratories attached to tertiary hospitals.

The National Institute for Communicable Diseases (NICD) is an organ of the NHLS and is the only WHO-accredited laboratory in the country. The NICD is mainly focused on epidemic-prone diseases, such as meningococcal meningitis, diarrhoeal diseases (including Malaria), Novel A influenza etc. The NICD serves as a national isolation laboratory for South Africa and for six other SADC Member States (Angola, Botswana, Lesotho, Mozambique, Namibia, and Swaziland).

4.2.4 Web-based surveillance reports

The South African Department of Public Health Surveillance System publishes web-based reporting from surveillance programmes on the NHLS and NICD web page –weekly during the influenza season and monthly at other times of the year (www.nmc.gov.za). Weekly web-based reporting from the measles surveillance programme was introduced due to the widespread measles outbreak in 2009.

Box 3: Good practice—Automatic laboratory alert system in South Africa

The outbreak response unit has collaborated with the NHLS Corporate Data Warehouse to develop an automated system for alerting response personnel to the diagnosis of priority communicable disease infections. The current system provides the Outbreak Reponses Unit with timely notifications and patient information following the confirmation of infections by NHLS laboratories.

The NHLS Corporate Data Warehouse is connected to every health facility in the country via a landline. Once results are analysed, they are transmitted automatically to the facilities. This includes all TB and HIV polymerase chain reaction results for children in the prevention of mother-to-child transmission programme. The NICD and all private sector laboratories are responsible for Malaria surveillance. Since Malaria is a notifiable condition in South Africa, the results are captured directly into the web- based notification system (with the GW17/5 notification paper base form as a backup.

The web-based notification system is connected to all laboratory databases (public and private), general practitioners' databases, and all private hospital databases for compulsory notification diseases, such as TB and Malaria. The web-based interconnection allows for interactions in three main ways:

- The individual laboratory can indicate a record by using the incident number generated by the web-based system, and create a separate field that record. Once the results are confirmed, an SMS or email alerts the nurse or requesting doctor, as well as relevant Government officials and the Ministry of Health's communications unit. This then triggers a response at all levels in order to verify the report;

- Connectivity can be achieved directly through interaction with the web service.
- Other countries (such as Namibia) can directly access their laboratory results by linking to the private sector laboratory database to reduce turn around time.

The Zimbabwe National Laboratory also uses email and fax to send results back to the requesting site.

Table 10: Destination supra-national reference laboratories for SADC Member States

Country	Destination supra-national reference laboratory
Angola	NICD and NHLS in South Africa
Botswana	NHLS Pretoria
DRC	Belgium
Lesotho	Path care private laboratory in Maseru for Malaria & NHLS PTA for MDR-TBNO
Malawi	Tanzania
Mauritius	India
Mozambique	India
Namibia	Lancet South Africa for MDR-TB to NHLS in Cape Town
Seychelles	N/A
South Africa	US CDC (Atlanta) for VHF and unexplained emerging conditions e.g. H1N1
Swaziland	MRC SA Durban (Malaria) for MDR-TB to NHLS in Pretoria
Tanzania	N/A
Zambia	SA NHLS PTA
Zimbabwe	SA NHLS PTA

4.3 Potential and feasibility of Telehealth for surveillance and information sharing

Beyond the minimum requirements shown in Tables 3 and Tables 5-7, SADC Member States have varying experiences with the use of Telehealth in disease surveillance. These experiences are reflected in Table 11, which also shows additional refinements in the requirements categories of ICT staff, connectivity and equipment are also shown.

Table 11: Other experiences with Telehealth tools and systems in disease surveillance in SADC Member States

Country	Current situation at Ministry of Health
Angola	Data transfer from provinces to Ministry of Health by email
Botswana	Ministry of Health uses health information system software (DHISv1.4) for collection and surveillance. Pilot programmes use cell phones for data collection
DRC	Data transfer with provinces by email
Lesotho	Data transfer in some disease programmes
Malawi	Data transfer in some disease programmes
Mauritius	Fully functional Telehealth system, including electronic port health disease surveillance system
Mozambique	Data transfer from district to province, and to Ministry of Health, by email when available
Namibia	Transfer of data from provinces on WAN or by email
Seychelles	Laboratory services and data collection
South Africa	Telehealth used for data sharing. Web-based disease surveillance and early warning system
Swaziland	Data transfer in disease programmes
Tanzania	Pilot SMS in Malaria programme
Zambia	Data transfer in some programmes
Zimbabwe	Some data transfer using emails

The state of Telehealth use in SADC Member States by functionality level in each application area is summarised in Table 12 (for disease surveillance and early warning), in Table 13 (for referral hospitals) and in Table 14 (for reference laboratories).

Member States are grouped in terms of their levels of functionality: Swaziland, Zambia and Zimbabwe are at Level I; Angola, Botswana, DRC, Lesotho, Malawi, Mozambique, Seychelles, Namibia and Tanzania are at Level II; and Mauritius and South Africa are at Level III.

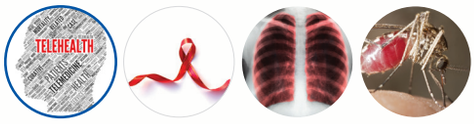


Table 12: Grouping of SADC Member States according to Telehealth functional capabilities in disease surveillance and early warning

Level: Functionality	Countries
I: Data collection, storage and analysis, with periodic non-automated updating and reporting	1. Swaziland 2. Zambia 3. Zimbabwe
II: Data collection, storage and analysis, with periodic non-automated updating and reporting with greater speed and reliability	1. Angola 2. Botswana 3. DRC 4. Lesotho 5. Malawi 6. Mozambique 7. Namibia 8. Seychelles 9. Tanzania
III: Data collection, storage and analysis with automatic updating and reporting (web-based, full early warning system)	1. Mauritius 2. South Africa

Table13: Grouping of SADC Member States according to Telehealth functional capabilities in referral hospitals

Level: Functionality	Countries
I: Communication between referring and receiving hospital without imaging	1. Swaziland 2. Zambia 3. Zimbabwe
II: Communication between referring and receiving hospital fully supported by imaging studies	1. Angola 2. Botswana 3. DRC 4. Lesotho 5. Malawi 6. Mozambique 7. Namibia 8. Seychelles 9. Tanzania
III: Full video-conferencing for real-time tele-consultations	1. Mauritius 2. South Africa

Table 14: Grouping of SADC Member States according to Telehealth functional capabilities in reference laboratories

Level: Functionality	Countries
I: Telepathology with store-and-forward technology	1. Swaziland 2. Zambia 3. Zimbabwe
II: Telepathology with remote reading of locally prepared and stored slides	1. Angola 2. Botswana 3. DRC 4. Lesotho 5. Malawi 6. Mozambique 7. Namibia 8. Seychelles 9. Tanzania
III: Real-time Telepathology with remote handling of slides from reference laboratory	1. Mauritius 2. South Africa

4.4 Readiness of telecommunications infrastructure for Telehealth services (surveillance, referral hospitals, reference laboratories)

Readiness of the telecommunication infrastructure for Telehealth activities is high in all Member States. Because the disease surveillance databases, referral hospitals and reference laboratories are located in the main cities of SADC Member States, the programmes are in a position to access some of the latest telecommunications infrastructure available in the region.

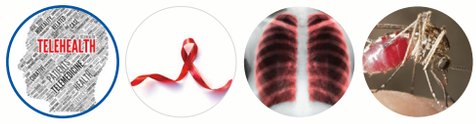
There are four modes of communications interconnection available in SADC Member States:

- Terrestrial communications systems;
- Wireless systems—either using the global system for mobile communications standard or the code division multiple access (CDMA) standard;
- Satellite-based systems; and
- Fibre optic cables systems.

All four modes are used in each SADC Member State.

Internet connectivity is provided through electronic exchanges, with ADSL services being available in well-resourced markets while ISDN services are available in other markets in each of the Member States.

Deployed in South Africa is another system, that of high-speed packet access plus (HSPA+). This is likely to extend to other SADC Member States in the coming years. ADSL and ISDN services are offered through fixed telephone lines. However, given the low penetration of fixed lines into areas outside capitals, ADSL and ISDN services are not readily available outside cities and large towns. Fibre optic cabling is a solution for reaching remote areas with broadband communication services, and all countries have plans to make this infrastructure available in the next 3-5 years. Fibre optic technology is also attractive since throughputs above 1 Mbps are a challenge for fixed telephone lines and mobile technologies.



4.4.1 Wireless telecommunications and mHealth initiatives

Wireless telecommunications services deserve specific mention since they are currently being used for disease surveillance and information sharing, and because the technology is well suited for reaching the largest numbers of health facilities. The penetration of mobile services is shown in Table 15.

Table 15: Cell phone diffusion in SADC Member States

Country	Mobile penetration (% of population)
Angola	43.8
Botswana	96.1
DRC	15.4
Lesotho	32.0
Malawi	15.7
Mauritius	84.4
Mozambique	26.1
Namibia	56.1
Seychelles	131.4
South Africa	92.7
Swaziland	55.4
Tanzania	39.9
Zambia	34.1
Zimbabwe	23.9

Source: ITU. The World in 2010: ICT Facts and Figures. Geneva: International Telecommunications Union; 2010. (http://www.itu.int/ITU-D/ict/material/FactsFigures2010.pdf

As wired connectivity is not readily available in remote areas, SADC Member States are leveraging the large diffusion of cell phone (mobile phone) technology for health purposes.

mHealth differs from eHealth in two respects: the use of mobile phone platforms and the implied mobility of the user. In at least three countries, mobile network operators are partnering with Governments to support pilot projects by offering reduced rates for network services. These examples are described in Box 4 (Botswana), Box 5 (Tanzania) and Box 6 (South Africa). They examples also indicate the potential scope of mobile platforms to support health services in SADC Member States, as they cover diagnostic services (Botswana), minimisation of medication stock-outs (Tanzania), and medication adherence for AIDS patients (South Africa).

Box 4: Good practice—Public-private partnership for eHealth in Botswana

In Botswana, collaboration between Orange Botswana, the Botswana-UPenn Partnership Programme and ClickDiagnostics Inc. of the U.S. has shown that mobile phones can be used effectively to enable doctors in the Princess Marina Hospital to diagnose patients that are far away (in Maun, Kasane and Tsabong). The pilot programmes focus on diagnosing and treating skin diseases, oral diseases, HIV and AIDS, and cervical pre-cancer disease, as well provide as mobile access to medical guidelines.

The SMS for Life project in Tanzania has shown how simple text messages can help manage the supply chain for Malaria medicines (see Box 5).

Box 5: Good practice—SMS for Life in Tanzania

A public-private initiative led by Novartis was established with the Roll Back Malaria partnership, IBM, Vodafone and the Ministry of Health of the Republic of Tanzania. The partnership developed a solution using mobile phones, SMS messages, Internet and mapping technologies to manage weekly stock inventories of Artemesinin-based Combination Therapies and quinine injectables at 129 health facilities and 226 villages. During the pilot, Malaria medicine availability improved significantly in all three districts: after 21 weeks, stock-out rates were reduced to zero in Lindi Rural, 47% in Kigoma Rural and 30% in Ulanga.

—Excerpted from the SMS for Life: Tanzania Pilot project report.

The application can be expanded easily to collect data for use in managing the supply chain for other medicines or commodities in the health sector, as well as for health events. It is designed and implemented as a service that is scalable, and can be extended and adapted to other SADC Member States. The success of the scheme has led to plans for full rollout to include other medicines and coverage of the entire Tanzania.

Cell phones are also used to remind patients of appointments and for adherence to treatment regimens. The Cape Town-based Cell-Life company's EMIT programme is an application for off-line data collection on cell phones, with the data then uploaded onto the district health information system (see Box 6).

Box 6: Good practice—Cell-Life in South Africa

Cell-Life, a South African company, has pioneered initiatives that provide effective technology-based solutions for the management of HIV and AIDS by addressing health-related logistical challenges, such as the provision and distribution of ART, continuous patient M&E, and collection and communication of relevant data. This is being done by using and developing innovative software supported by existing technologies such as mobile phones and the Internet.

4.4.2 Disease surveillance

As shown in Table 3, all Member State disease surveillance programmes currently have Internet connectivity with high-speed broadband connections, except for Swaziland (64 Kbps) and Zimbabwe (128 Kbps).

4.4.3 Referral hospitals

The Pan African eNetwork for Telemedicine and Tele-education project is a continental initiative with a telemedicine component that eventually will link one hospital per country in a satellite-based network.

It has begun in eight SADC Member States, but is fully functional only in Mauritius, which hosts a regional super-specialty hospital (cancer). The network has eight patient-end hospitals—in Botswana, Malawi, Mauritius, Mozambique, Seychelles, Tanzania, Zambia and Zimbabwe. The network is based on satellite connectivity and offers courses to all nodes, (see the sample of continuing medical education courses for the month of June 2011, as shown in Annex 6).

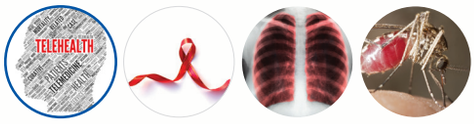
4.4.4 Plans for satellite-based telecommunications at the SADC Secretariat

The ICT Unit at the SADC Secretariat reported that it was preparing a strategic plan for ICT in line with the e-SADC strategy. As part of the strategy, the Unit planned to set up a satellite-based communication system to connect all SADC focal points in each country (located either at the Ministry of Foreign Affairs or the Ministry of Finance). The same network would be used for Customs. The time frame for the initiative is relatively short, with a main dish due to be set up in Botswana along with one in South Africa during the first phase, and deployment to all SADC Member States in the following 12-15 months.

It is recommended that each SADC project secure its connectivity by buying the required bandwidth from the overall SADC satellite connection. The SADC Council of Ministers has taken a policy decision on sharing of facilities among the different ministries. The ICT Unit is therefore committed to providing technical assistance to programmes for leveraging the systems. Although there were only three staff members in the Unit as of December 2010, there are plans for further growth with an option of outsourcing tasks when needed.

4.5 Status of equipment for Telehealth (surveillance, geographic information system, database)

The overall situation with regard to equipment for Telehealth in SADC Member States correlates with ADF (African Development Fund) status. The non-ADF SADC Member States are well equiped for Telehealth in disease programmes. In Botswana, Mauritius, Namibia, Seychelles, South Africa and Swaziland, disease programmes readily have a server (with a backup server), a laptop, Internet connectivity and LAN or WAN to connect users, as well as printers for outputting information. They also have either reliable electrical power or UPS devices to provide backup power.



The situation in SADC ADF Member States is often quite different and merits special attention, since these countries would be supported directly by the SADC Secretariat in terms of equipment acquisition to support a fully functional Telehealth network. The situation in these Member States is shown in Tables 16a, 16b and 16c.

Table 16a: Database equipment in SADC ADF Member States: HIV and AIDS

Country	Database equipment	Equipment currently in place
Angola	A: Server	A, D, E, F, G
DRC	B: Backup server	A, D, G
Lesotho	C: Laptop	D, F, G
Malawi	D: LAN/WAN	A, D, G
Mozambique	E: UPS	A, D, G
Tanzania	F: Printer	A, B, D, G
Zambia	G: Internet	D, G
Zimbabwe		A, D, G

Table 16b: Database equipment in SADC ADF Member States: TB

Country	Database equipment	Equipment currently in place
Angola	A: Server	A, D, E, F, G
DRC	B: Backup server	A, D, G
Lesotho	C: Laptop	D, F, G
Malawi	D: LAN/WAN	A, D, G
Mozambique	E: UPS	A, D, G
Tanzania	F: Printer	A, B, D, G
Zambia	G: Internet	D, G
Zimbabwe		A, D, G

Table 16c: Database equipment in SADC ADF Member States: Malaria

Country	Database equipment	Equipment currently in place
Angola	A: Server	A, D, E, F, G
DRC	B: Backup server	A, D, G
Lesotho	C: Laptop	D, F, G
Malawi	D: LAN/WAN	A, D, G
Mozambique	E: UPS	A, D, G
Tanzania	F: Printer	A, B, D, G
Zambia	G: Internet	D, G
Zimbabwe		A, D, G

All eight ADF Member States have Internet connectivity and a LAN or WAN for all three disease surveillance programmes. Six (75%) of the ADF Member States have servers deployed, although only one (Tanzania) has a backup server. Dedicated laptop computers, an essential feature of any Telehealth network, are not available in any of the programmes.

4.5.1 Geographic information system

A GIS plays an important role in disease surveillance. It can be used to:

- Determine geographic distribution of diseases;
- Analyse spatial and temporal trends;
- Map populations at risk;
- Stratify risk factors;
- Assess resource allocation;
- Plan and target interventions; and
- Monitor diseases and interventions over time.

The situation in the SADC region is shown in Tables 17 and 18. Nine Member States have and use GIS in their disease surveillance activities, while five lack such systems.

Table 17: Use of geographic information systems in SADC Member States

Country	Have GIS?	Number of trained users	Installed software
Angola	Yes	18	Grafo Win, Kosmo, Epi-Info
Botswana	Yes	1*	Health Mapper, Google Maps
DRC	Yes	19	ArcView GIS 9.3, QUANTUM GIS
Lesotho	No	N/A	N/A
Malawi	No	N/A	N/A
Mauritius	No	N/A	N/A
Mozambique	No	N/A	N/A
Namibia	Yes	3	ArcView Explorer
Seychelles	Yes	In another Ministry	ArcView GIS
South Africa	Yes	No data	ArcGIS, ETR, DHIS, Web-pivot GIS
Swaziland	Yes	3	ArcView GIS
Tanzania	Yes	5	Health Mapper, Google
Zambia	No	N/A	N/A
Zimbabwe	Yes	1	Custom software

*Key: * = 1 in Dec 2010 and 25 in June 2011*

Table 17 shows the availability and use of GIS services for all SADC Member States, while Table 18 shows the situation with regard to GIS equipment in SADC ADF Member States. Nine SADC Member States have GIS services, while five Member States lack them. Four of the five the Member States without GIS services are ADF countries; half of all ADF Member States therefore are without GIS.

In the four ADF Member States with GIS (Angola, DRC, Tanzania and Zimbabwe) there are no dedicated GIS servers, although software is available to run on stand-alone computers. Even where there is GIS in ADF Member States, scanners are not available, thus limiting the scope of the services.

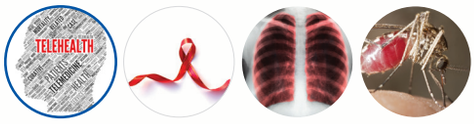


Table 18: Geographic information systems equipment in SADC ADF Member States

Country	GIS equipment	Equipment currently in place
Angola	A: GIS server	B, C, D
DRCongo	B: A1 plotter	C, D
Lesotho		None
Malawi	C: Printer	None
Mozambique		None
Tanzania	D: Software	C, D
Zambia	E: A3 scanner	None
Zimbabwe		D*

*Key: * = Custom software*

5. DISCUSSION

5.1 General findings (policy, legal and regulatory environment, human and financial resources)

Telehealth has many requirements beyond the connections that link the nodes of the system. The technology is a tool and must serve a higher purpose—in this case, gathering intelligence about diseases (needs and burdens) and informing the subsequent actions of countries in the network. There are broader issues, therefore, that affect the operation of a Telehealth system—such as policy and strategy, infrastructure, and human and financial resources. This section reviews those issues, after first presenting an overview of the health systems in SADC Member States.

5.1.1 Overview of the health information system

The Telehealth system has to match the goals of the health information system. Paper-based data collection and analysis systems (currently the main method used at sub-national levels in most SADC Member States) presents a significant challenge in terms of accurate data capture, ease of analysis and, especially, sharing the information and knowledge that is derived from those analyses. Electronic storage (and preferably also capture) of data therefore is important for eHealth initiatives.

5.1.2 Policy criteria

It is important for countries to have both a policy and a strategy to guide their ICT for health initiatives and projects. An eHealth policy is a statement of intent and a commitment to certain principles to guide decisions and actions towards a desired outcome that is based on the use of ICT in the health sector. An eHealth strategy then spells out how the policy should be implemented to achieve the desired outcome. Policy and strategy can be likened to the rails on which the eHealth enterprise runs.

The absence of eHealth policies and strategies in all but two SADC Member States poses a problem. Where there is no policy, one should be developed. Policy and strategy documents should be shared widely throughout the health workforce (the eventual implementation agents). Such strategies and roadmaps would serve to guide not only the implementation of the SADC Telehealth TNDS, but also the numerous eHealth initiatives that are being undertaken in Member States—without a master plan. A harmonised eHealth strategy is needed if the TNDS system is to function properly.

5.1.3 Regulatory environment

Ethical and legal issues are an important consideration in eHealth, as a whole and for Telehealth, in particular, because there is potential for breaches of security, privacy and confidentiality of citizens' personal information. WHO has identified this as a priority action area for countries when implementing eHealth. Security, privacy and confidentiality therefore are key aspects of eHealth strategies and master plans. Appropriate regulatory mechanisms to ensure these safeguards include practice guidelines, Ministerial orders and legislation.

5.1.4 Human resources

As indicated earlier, attracting ICT experts to fill positions in health facilities is a challenge. Incentives are needed to draw technical expertise to the health sector in general, and especially to service in provinces. Another major issue in all SADC Member States is the capacity to use existing and planned Telehealth capabilities.

The primary areas of ICT expertise needed in the health sector in Member States are:

- eHealth managers that are capable of leading policy and strategy development;
- Technical staff that is capable of installation, maintenance and repair of Telehealth systems; and
- Expertise in training other health workers to use the ICT systems.

The other dimension of the human resources is that of building human capacity to use the ICT services that are deployed in the health system. All health professionals should develop ICT-user skills in order to leverage the technology to improve their work.

Table 16 (in Annex 5) shows the typical situation across the SADC region. There are tools and instruments available to use ICT platforms, but the use of the Internet is the most crucial element. When this is not available (whether because it is not installed or because it is down), significant opportunities to build ICT skills in the health sector are lost.

Two other forms of capacity building are needed: for use and for maintenance. Training is also required, since human resources are needed in all countries to enhance use of the existing infrastructure, improve disease surveillance and strengthen other aspects of the health system.

Staff turnover can exacerbate the difficulties. In countries with a policy of staff rotation (such as in Botswana, which has a two-year maximum tenure at a given station), the situation is further complicated.

5.1.5 Financial resources

Financial resources for the health sector as a whole are limited, and especially for ICT in health, despite the recognition that ICT is essential to improving health services. The immediate needs for implementing the TNDS will have to be met through other funding mechanisms, such as Ministry of Health budgets, sector-wide approach) funds, and direct donor or partner support.

5.2 Current use of Telehealth for surveillance

5.2.1 Disease surveillance

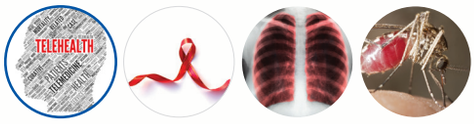
The assessment shows that eleven (11) of the fourteen 14 SADC Member States (78.7%) have the basic minimum requirements. Furthermore, every SADC Member State has the potential for Telehealth in disease surveillance given adequate Internet connectivity. The main challenge in the six Member States can be addressed through the creation of a Telehealth network for diseases surveillance.

All Member States have expressed interest in Telehealth and most of them have current experience with some Telehealth platforms and tools, which bodes well for the uptake of a TNDS.

Three Member States are at Level I functionality, 9 Member States are at Level II, and 2 Member States are at Level III. The specific resources associated with each functionality level, will be useful in identifying member state needs in order to transition to the next functionality level. These groupings and transition requirements hold true for referral hospitals, as well as for reference laboratories (and hence will not be repeated in each sub-section).

5.2.2 Referral hospitals

A majority of referrals between SADC Member States goes to South African medical facilities. The referral hospitals visited during the assessment all have connectivity of some sort, although the reliability and bandwidth generally can be improved. The situation is similar for Ministries of Health, six of which have the minimum requirements for Telehealth; adequate connectivity is the main limiting factor. Nevertheless, referral hospitals in SADC Member States have experience with Telehealth systems and tools, and Telehealth is therefore feasible. Given the roles that national referral hospitals play in case management of patients, they need to be part of the network for Telehealth for disease surveillance.



The Pan-Africa eNetwork offers continuing medical education courses to all nodes, although the scheduling of the courses and some of the content are not optimal for the SADC sites (see, for example, the sample of courses for the month of June 2011 shown in Annex 3). The architecture of the network also required improvement, as nodes cannot communicate directly with one another to share locally relevant experiences. Instead they can only connect to super specialty hospitals in India and to the Sir Seewoosagur Ramgoolam National Hospital in Port Louis, Mauritius. The diagnosis and consultation aspect is thus also linked to these referral hospitals. The only centre that has links with other SADC institutions is the Sir Seewoosagur Ramgoolam National Hospital, due to its special status of a super specialty hospital for the Eastern Region of the project, which covers the SADC region.

5.2.3 National reference laboratories

National reference laboratories use electronic notification for results in nine out of the 13 SADC Member States for which data were obtained. Laboratory samples that are sent for specialised testing and verification are often sent to the Medical Research Council of South Africa.

Laboratory confirmation of diseases makes national reference laboratories the third leg of the Telehealth network for disease surveillance.

5.3 Potential and feasibility of Telehealth for surveillance and information sharing

There is a need to use Telehealth as a surveillance and information-sharing tool for communicable and other diseases in the SADC region. There is keen interest to do so in all SADC Member States, with health professionals recognizing the value in a Telehealth network.

Such a network needs to be part of a broader effort to apply ICT positively in the health system. ICT is the basis of the knowledge-based health systems of the 21st century. Teleheath services need to become an essential part of every SADC Member State's health system. The eight priority action areas for eHealth identified by WHO are appropriate for eHealth in SADC Member States.

The assessment shows that the potential to use Telehealth exists in all SADC Member States; adequate Internet connectivity means that they meet the minimum requirement. However, in one Member State this potential is qualified by the absence of Telehealth policy, strategy and trained staff, and by poor connectivity and a lack of web-based services. Conversely, the Telehealth potential in Mauritius far exceeds the minimum requirements.

5.4 Readiness of telecommunications infrastructure for Telehealth services (surveillance, referral hospitals, reference laboratories)

A SADC Secretariat ICT network, as suggested to the Consultants, would provide the infrastructure for transmitting data on HIV and AIDS, TB and Malaria from Ministries of Health in countries to the SADC Secretariat in a timely manner.

Furthermore, push operations could be automatically triggered when designated indicators exceed certain thresholds. The system could also allow the SADC Secretariat to access the data as needed, rather than wait for it to be provided by countries. Such a system also could be extended to serve a referral hospital and national reference laboratory in each Member State, by linking these units to the SADC network access point in each Member State.

5.5 Status of equipment for Telehealth (surveillance, geographical information system, database)

The assessment shows that some Member States, notably Mauritius, command more than the minimum requirements in terms of available infrastructure and equipment to serve as the core of a fully functional TNDS. However, leveraging the existing equipment and software for the core functionalities of the network would introduce significant challenges of compatibility within and countries. An alternative approach would be to identify a set of equipment and functionalities for the network, which each country would acquire, preferably through the TNDS initiative. Such a system would allow connection of existing equipment to the network.

Planning and maintenance of equipment are important considerations. Plans are needed for both preventive and corrective maintenance of equipment used for Telehealth, beyond the warranty periods of these items. This could be done either through in-house or outsourced arrangements.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 General findings (policy, legal and regulatory environment, human resources and financial resources)

6.1.1 National eHealth policy and strategy

- In those SADC Member States without a published eHealth strategy, a national eHealth strategy should be developed and published.
- Ideally, the strategy development process should form part of the broader national information and communication infrastructure (NICI) and sectoral information and communication infrastructure (SICI) processes which UNECA supports in African countries.
- The SADC Secretariat should support Member States in this effort by providing technical assistance.

6.1.2 Regulatory environment for ICT in health

- All SADC Member States should develop and maintain an up-to-date regulatory environment for the use of ICT in the health sector, including the assignment of unique identifiers for all citizens that are useable throughout the region (see recommendation on eGovernment).

6.1.3 Centralised Telehealth Network for Disease Surveillance system

- SADC should promote the development of an interconnected TNDS, with three sub-networks focusing on disease surveillance, referral hospitals and reference laboratories. Proper management and support from the SADC Secretariat will be key for successful implementation.
- The SADC Secretariat should provide financial support to countries to cover both capital and recurrent expenditures, since it is clear that the success of the SADC TNDS (even in some non-ADF countries) will depend on such support.

6.1.4 Access to broadband services through eGovernment

- The health sector in each SADC Member State should leverage existing eGovernment programmes for the provision of broadband connectivity, equipment and training. These programmes should include an eGovernment Interoperability Framework (eGIF) to facilitate the sharing of data among government ministries.
- Each citizen should be given a unique identifier, which will serve all sectors of the economy, including health.
- The SADC Secretariat should promote the development of eGIF in Member States, along with the effective participation of the health sector in eGovernment infrastructure programmes.

6.1.5 Human resources for ICT in health

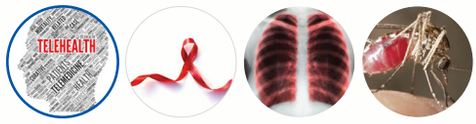
- The health sector should leverage eGovernment initiatives to train a cadre of eHealth experts to support all components of the TNDS.

6.1.6 Reliable Ministry of Health email services

- Ministries of Health should promote the use of Ministry of Health domains for email use by staff and take the necessary steps to improve the availability and quality of this service to all professional health workers.

6.1.7 Electronic records

- All SADC Member States should draw up plans for migrating their systems towards electronic data capture, transfer, processing, sharing and storage, with adequate backup in the event of failure in primary storage units.



6.2 Current use of Telehealth for surveillance

The assessment has shown the breath and scope of current uses of Telehealth in disease surveillance and information sharing. SADC Member States can be grouped into three categories in terms of their use of Telehealth: three Member States are at Level I functionality, nine are at Level II, and two are at Level III.

- The activities in each Member State would form part of the environmental scan in preparing eHealth national plans, and would also constitute the basis of the road map for future eHealth activity in each country. It is therefore important that Member States catalogue (in electronic format) their Telehealth initiatives, projects and activities. Once shared, these can serve as a rich source of knowledge and information, nationally and regionally.

6.3 Potential and feasibility of Telehealth for surveillance and information sharing

- All SADC Member States should promote professional networking and sharing information nationally, while SADC should support referrals and sharing of information and knowledge among referral hospitals in the region.

- All SADC Member States should ensure that national reference laboratories have reliable means for making and receiving electronic requests and performing electronic notification, through adequate and reliable ICT infrastructure, appropriate equipment, tailored training programmes and adequate technical service units for maintenance.

- SADC should promote professional networking and sharing with other national reference laboratories and supra-national laboratories.

6.4 Readiness of telecommunications infrastructure for Telehealth services (surveillance, referral hospitals, reference laboratories)

- All SADC Member States should ensure that disease surveillance programmes for HIV and AIDS, TB and Malaria have reliable means for capturing and sharing epidemiological and other data electronically. This implies adequate and reliable ICT infrastructure, appropriate equipment, tailored training programmes and adequate technical service units for maintenance.

- All SADC Member States should ensure that a national referral hospital has reliable means for making and receiving electronic referrals, with accompanying documentation sent electronically. This requires adequate and reliable telecommunications infrastructure, tailored training programmes and adequate technical service units for maintenance.

- All SADC Member States should ensure that a national reference laboratory has reliable telecommunications infrastructure for electronically providing notifications and other reference laboratory services.

- SADC should support all Member States in their efforts to implement these recommendations, and it should provide financial support and technical assistance to ADF Member States toward that end.

Non-ADF Member States should use national budgets and donor support for this purpose.

6.5 Status of equipment for Telehealth (surveillance, geographical information system, database)

Planning and maintenance of equipment are important activities in disease surveillance programmes.

- All SADC Member States should ensure that disease surveillance programmes for HIV and AIDS, TB and Malaria have reliable and appropriate equipment for full Telehealth functionality.

Equipment and other resources will be needed for Member States to transition from one functionality level to the next.

- The SADC Secretariat should provide the necessary and needed equipment for ADF countries. For non-ADF countries, national budgets and donor support should be mobilised for this purpose.

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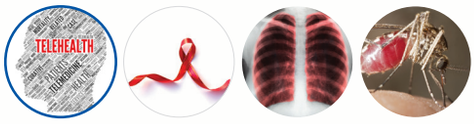

Additional documents

1. Documents available from SADC Secretariat, such as the ADB appraisal report for the control of communicable diseases project
2. SADC. The SADC harmonised surveillance framework for HIV and AIDS, Malaria and TB. Gaborone: SADC, 2010
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e) Minutes of Meeting of SADC Ministers of Health and Ministers responsible of HIV and AIDS (11 -12 Nov 2009) Swaziland
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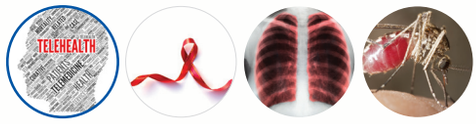
ANNEX 1: TARGET RESPONDENTS AND KEY AREAS OF RELEVANCE TO SURVEILLANCE, TERTIARY HOSPITALS AND LABORATORIES

Respondent	Relevance to the assignment (terms of reference)
National Health Information Systems Manager	· Exploration of links to existing health information systems, such as GIS, IDSR and notifications systems etc.
Country Programme Manager for Malaria or Vector-borne Diseases	· Respondent for Malaria SWOT analysis
Country Programme Manager for HIV and AIDS and STI	· Respondent for HIV and AIDS SWOT analysis
Country NTP Programme Manager	· Respondent for Malaria SWOT analysis
National M&E Manager	· Manages the collation of HIV and AIDS, Malaria and TB data · Monitors national indicators data
National Epidemiology Manager	· Disease surveillance and outbreak technical support and National CDC outbreak coordination point · Establish the early warning (detection) system
Bio-Statistician	· Data management, analysis and interpretation · Access to the central statistics mortality data and link with Ministry of Health
Epidemiologist	· Data validation, interpretation and synthesis, and data dissemination point · Manages the Disease Notification System, including the IDSR focal point · Ministry of Health data focal point
Minister of Health Legal Advisor	· To advise minister on drafting of MOA on patient referral between and within SADC Member States · Draft MOA for Member States readiness to host regional services (SNRL) · Draft MOA for Member States to share data
National Referral Hospital CEO	· To assist in contextualisation of Telehealth surveillance for national tertiary services · To assess mechanisms for data/information on centers of excellence within the region · To assess if the tertiary hospitals adhere to clinical and administrative guidelines for referral of patients, within and between SADC State parties · To assess human resource capacity building that will provide appropriate high-quality specialist care through the exchange and attachment of specialists in the region
National Reference Laboratory Manager or Senior Technician	· To assist in contextualisation of Telehealth surveillance for the national reference laboratory · Assess whether the Malaria and TB-HIV co-infection analysis meets the minimum standards · Assess turnaround time for MDR-TB and XDR-TB analysis done in other countries · Assess Member States' readiness to develop coherent regional policies and strategies to strengthen laboratory services and quality assurance
Member States SADC focal point	· To coordinate the implementation of the project within the Member State



ANNEX 2: THE ADAPTED WHO HEALTH MATRIX NETWORK TOOL

(This is formatted as a set of spreadsheets in Excel)

ANNEX 3: SADC ASSESSMENT OF TELEHEALTH—PROTOCOL FOR CONDUCTING INTERVIEWS

Attendance List

Circulate attendance form with columns for:

- Name
- Position/title
- Phone
- Cell
- Email

Introduction of country officials

Word of thanks and welcome to SADC assessment of Telehealth project

Introduction of the team—team leader followed by team members

Objectives of the assessment—team leader

The main objective of the study visit is to carry out a country situation analysis, to inform the design of the Telehealth network. As such the team wants to gather information in the following areas:

- Infrastructure;
- Connectivity;
- Equipment; and
- Human resources.

What exists as well as what is planned for the near future?
Is there a strategic plan for ICT in the health sector?

Two questionnaires to be filled out to capture more specific data to complement the discussion.

Focused interview guided by study objectives

1. Assess the extent to which Telehealth is currently being used as a surveillance and information sharing tool in SADC Member States:

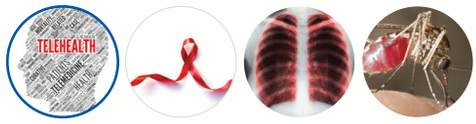
- Explanation of national disease surveillance programmes;
- Elicit information on use of ICT at various levels for:

- Data collection;
- Types of equipment used—computers, personal digital assistants, smart phones, ordinary cell phones;
- Data transfer between levels—removable disk, email, WAN, Internet (web).

2. Explore the potential and feasibility of Telehealth as a surveillance and information sharing tool in the SADC region:

- Elicit information on use of ICT for exchanging information:

- Between levels in the system;
- Plans for electronic sharing of information with SADC Secretariat—email, WAN, Internet (web), VPN;
- Plans for electronic sharing of information with other SADC Member States—email, WAN, Internet (web), VPN;
- What additional capabilities would be needed—equipment, connectivity.



3. Assess the state of telecommunication infrastructure in terms of readiness to accommodate Telehealth services:

- Elicit information on use of ICT at various levels for:

- Data collection;
- Types of equipment used—computers, personal digital assistants, smart cell phones, cell phones;
- Data transfer between levels—removable disk, email, WAN, Internet (web).

4. Identify the equipment currently available in Member States that can be used for the establishment of a fully functional Telehealth system for diseases surveillance:
- Elicit information on use of ICT at various levels for:

- Data collection;
- Types of equipment used—computers, personal digital assistants, smart cell phones, cell phones;
- Data transfer between levels—removable disk, email, WAN, Internet (web).

5. Define specifications for the proposed Telehealth equipment including geographical information system and database

- Elicit information on use of ICT at various levels for:

- Data collection;
- Types of equipment used—computers, personal digital assistants, smart cell phones, cell phones;
- Data transfer between levels—removable disk, email, WAN, Internet (web).

6. Propose how the Telehealth systems can be used as an early warning system for epidemic outbreaks

- Elicit information on use of ICT at various levels for:

- Data collection;
- Types of equipment used—computers, personal digital assistants, smart cell phones, cell phones;
- Data transfer between levels—removable disk, email, WAN, Internet (web).

7. Assess the human resource requirements for supporting a fully functional Telehealth system in the SADC region

- Elicit information on capacity to use ICT at various levels for:

- Data collection;
- Data analysis;
- ICT training programmes for staff;
- Planning and design of disease surveillance system—system analysts, software developers;
- Maintenance expertise for hardware and software—in-house maintenance staff (engineers, technicians), outsourcing of maintenance.

Annex 3B: A structured questionnaires: Questionnaire used with key informants and the SWOT analysis

SADC Member States Strength Weaknesses, Opportunities and Threats Analysis assessment

The individual SADC Member strengths are factors that can easily be controlled by the Ministries doing more on institutional development. Therefore, assessment of these factors focused on gathering information from the assignment respondents on the following:

- What they know best (experience), i.e. current HIV and AIDS, Malaria and TB surveillance systems operational amongst the Member States diagnosis (use of ICD 9 and ICD 10 codes);
- Requirement for clinical diagnosis and access to laboratory results for patients;
- Available policy and legislation;
- Experience on specific disease burden;
- Have they established paper-based and electronic surveillance systems;
- Have they established surveillance processes and mechanisms for data flow and dissemination;
- Do they have expertise in surveillance human resources (lab, ICT, HIM);
- Do they have the potential to establish early warning systems;
- Can they establish internal mechanisms to collate data at a central point;
- Use of Telehealth as a tool for disease surveillance;
- Feasibility of Telehealth System;
- Infrastructure readiness for Telehealth;
- Variable equipment for Telehealth surveillance;
- Human resource requirements for Telehealth;
- Allocated budget for use of ICT in the health sector.

The SADC Member State weaknesses assessment focused on gathering information from the assignment respondents on the following:

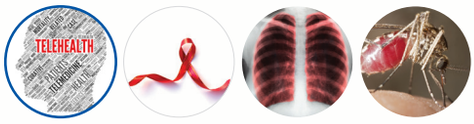
- Capacity for diagnosis (drug-resistant TB and Malaria);
- Do Ministry of Health officials know where the gaps are;
- Capacity to implement vertical programmes instead of operating in a silo without coordination between the HIV and AIDS and national TB programmes, when it is known that 70% of TB patients are HIV-positive;
- Capacity for human resources skills and expertise;
- Financial resource capacity;
- Implementation of SADC, WHO resolutions.

The SADC Member State threats are indicators of health that lie outside the powers within the Ministry of Health and compound the ability of Member States to control the burden of the three disease epidemics. Threatening factors are:

- Need external assistance to succeed in control, such as access to HIV drugs;
- Referral of diagnosis of MDR-TB, TB cultures to national reference laboratories or supra-national reference laboratories in other countries;
- Dependency on donor funding;
- Economic impact;
- Climate change;
- Availability of vectors for Malaria;
- Need SADC advocacy;
- Build and strengthen partnerships;
- Financial planning cycles of Ministry of Health and donors not aligned.

SADC Member State opportunities can catalyse the strengths and the assessment of these factors focused on gathering information from the assignment respondents on the following:

- Global interests like (ICT and Telehealth) which may result in shared interests;
- What are the Member States opportunities in establishing the proposed Telehealth system;
- How Member States see the proposed Telehealth reducing morbidity and mortality due to HIV and AIDS, Malaria and TB, how they can achieve the Millennium Development Goals, how they can improve laboratory capacity and the patient referral system between and within Member States.



ANNEX 4: SPECIFIC ARTICLES OF THE SADC PROTOCOL ON HEALTH OF PARTICULAR RELEVANCE TO THE STUDY

Article 6: Health system research and surveillance

Member States shall:

a. Share information on health systems research and surveillance and co-operate and assist each other in its dissemination;
b. dentify and conduct health systems research using, among others, the Essential Regional Health Research; and
c. Cooperate and assist each other in regional surveillance with respect to communicable and non-communicable diseases, and to develop a common set of indicators for these diseases.

Article 7: Health information systems

In order to ensure access to good quality health data and its use in planning and managing health systems, State Parties shall develop and formulate coherent, comparable, harmonised and standardised policies with regard to:

a. Development of a health information systems policy framework;
b. Development of common definitions and a common data dictionary;
c. Establishment of mechanisms for information exchange;
d. Establishment of SADC Regional Data of Health and Social Service Indicators; and
e. Development of Telehealth applications.

Article 9: Communicable disease control

1. State Parties shall cooperate to harmonise, and where appropriate, standardise policies in the areas of:

a. Case definitions for diseases;
b. Notification systems; and
c. Treatment and management of major communicable diseases.

2. State Parties shall cooperate in the establishment of regional reference laboratories and in sharing technical expertise in order to ensure high immunisation rates to reduce, eliminate, and where possible eradicate communicable diseases.

3. State Parties shall share information related to outbreaks and epidemics of communicable diseases within the Region and work together in epidemic control and management.

Article 10: HIV and AIDS and sexually transmitted diseases

1. In order to deal effectively with the HIV/AIDS/STDs epidemic in the Region and the interaction of HIV/AIDS/STDs with other diseases, State Parties shall:

a. Harmonise policies aimed at disease prevention and control, including cooperation and identification of mechanisms to reduce the transmission of STDs and HIV infection;
b. Develop approaches for the prevention and management of HIV/AID/STDs to be implemented in a coherent, comparable, harmonised and standardised manner;
c. Develop regional policies and plans that recognise the intersectoral impact of HIV/AIDS/STDs and the need for an intersectoral approach to these diseases; and
d. Cooperate in the areas of: (i) Standardisation of HIV/AIDS/STDs surveillance systems in order to facilitate collation of information which has a regional impact; (ii) Regional advocacy efforts to increase commitment to the expanded response to HIV/AIDS/STDs; and (iii) Sharing of information.

2. State Parties shall endeavour to provide high-risk and trans-border populations with preventative and basic curative services for HIV/AIDS/STDs.

Article 11: Malaria control

1. State Parties shall establish efficient mechanisms for the effective control of Malaria in the Region.

2. State Parties shall cooperate and assist one another in order to reduce the prevalence of Malaria, and with support from stakeholder, ensure the optimal use of resources for, inter alia:

a. Sharing scarce technical resources and operational research;
b. Harmonising goals, policies, guidelines, protocols, interventions and treatment regimens; and
c. Integrating Malaria control mechanisms into primary health care services.

Article 12: Tuberculosis control

In view of the seriousness of TB in the Region, State Parties shall cooperate and assist one another to:

a. Develop strategies for the sustained control of TB, including the efficient supply and delivery of drugs; and
b. Ensure, where appropriate, the harmonisation of TB control activities and HIV/AIDS programmes.

Article 25: Emergency health services and disaster management

State Parties shall:

a. Cooperate and assist each other in the coordination and management of disaster and emergency situations;
b. Collaborate and facilitate regional efforts in developing awareness, risk reduction, preparedness and management plans for natural and man-made disasters; and
c. Develop mechanisms for cooperation and assistance with emergency services.

Article 26: Health laboratory services

State Parties shall:

a. Cooperate and support one another to develop acceptable standards in laboratory services and the training of medical laboratory scientists; and
b. Develop coherent regional policies and strategies to strengthen laboratory services and quality assurance.

Article 27: Health technology and equipment

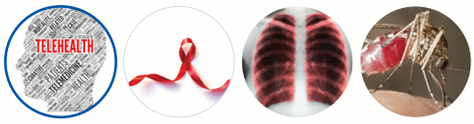
State Parties shall cooperate in the:

a. Development and formulation of coherent, comparable, harmonised and standardised policies and strategies on health technology and equipment;
b. Procurement and maintenance of equipment;
c. Sharing of information, training and skills development on particular equipment; and
d. Control of ionising radiation and radioactive material.

Article 28: Referral systems

State Parties shall co-operate and assist one another in the harmonisation of policies, mechanisms, procedures and strategies with regard to tertiary care services including:

a. The establishment of appropriate clinical and administrative guidelines for referral, within and between State Parties;
b. Progressively building capacity in State Parties to provide appropriate high-quality specialised care through the exchange and attachment of specialists in the Region; and
c. The sharing of information on centres of excellence in the Region.



ANNEX 5: ILLUSTRATIVE RESPONSE TO QUESTIONNAIRE SECTION ON POLICY ISSUES

With the exception of Mauritius, the policy and regulatory environment is depicted as shown in Table 15 . The fact that the respondent is unaware of the existence of policies on the use of ICT in the health sector is a problem that needs to be addressed.

Table 15: Response to questionnaire about policy and regulatory environment

Statements	Score					
Policy readiness (at institutional / government level)	1	2	3	4	5	D/K
1. 1 ICT related regulations:						
1.1.1 Government policies are in place to promote and manage use of Telehealth/ eHealth in healthcare institutions	1	2	3	4	5	D/K X
1.1.2 Institutional policies are in place to promote and manage use of Telehealth/ eHealth in your institution	1	2	3	4	5	D/K X
1. 2 Policies regarding licensure and liability:						
1.2.1 Government policies are in place to allow transfer of health data from one jurisdictions to another through Telehealth	1	2	3	4	5	D/K X
1.2.2 Institutional policies are in place to allow transfer of health data from one jurisdictions to another through Telehealth	1	2	3	4	5	D/K X
1.3 Awareness and support of ICT among policy and decision makers						
1.3.1 Policy makers are generally aware of the benefits of ICT use in health	1	2	3 X	4	5	D/K
1.3.2. Policy makers generally support the use of ICT in health	1	2	3 X	4	5	D/K
1.4 Awareness and support of ICT among policy-makers at the institutional level:						
1.4.1 Policy makers at the institutional level are aware of the benefits of ICT use in health	1	2	3 X	4	5	D/K
1.4.2 Policy makers at the institutional level support the use of ICT in health	1	2	3 X	4	5	D/K

Table 16: Example of response with regard to readiness for eLearning—1

Statements	Score					
Learning readiness (training in ICT use)	1	2 X	3	4	5	D/K
2. 1 ICT/ internet training for healthcare providers:						
2.1.1 Personnel and programmes are in place for training in use of ICT	1	2	3	4 X	5	D/K
2.2. Use of ICT/ internet to enhance education of care providers:						
2.2.1 Programmes exist for continuing education	1	2	3 X	4	5	D/K
2.2.2. Programmes are in place to use ICT/ Internet for continuing education	1	2	3 X	4	5	D/K
2.2.3 ICT/ Internet is readily used in continuing education	1	2 X	3	4	5	D/K
2.3. Involvement of surveillance and other health professionals in Telehealth/eHealth programmes:						
2.3.1 Health professionals are involved in the planning of new Telehealth/eHealth interventions	1	2	3	4 X	5	D/K
2.3.2 Health professionals are involved in the implementation of new Telehealth/ eHealth interventions	1	2	3	4 X	5	D/K

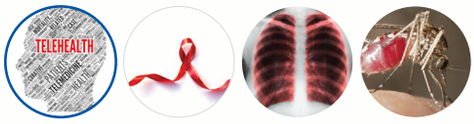
Table 17: Example of response with regard to readiness for eLearning – 2

Statements	Score					
Learning readiness (training in ICT use)	1	2	3	4	5	D/K
2.1 ICT/ internet training for healthcare providers:						
2.1.1 Personnel and programmes are in place for training in use of ICT	1	2	3	4	5	D/K
2.2 Use of ICT/ internet to enhance education of care providers:						
2.2.1 Programmes exist for continuing education	1	2	3	4	5	D/K
2.2.2 Programmes are in place to use ICT/ Internet for continuing education	1	2	3	4	5	D/K
2.2.3 ICT/ Internet is readily used in continuing education	1	2	3	4	5	D/K
2.3. Involvement of surveillance and other health professionals in Telehealth/eHealth programmes:						
2.3.1 Health professionals are involved in the planning of new Telehealth/eHealth interventions	1	2	3	4	5	D/K
2.3.2 Health professionals are involved in the implementation of new Telehealth/ eHealth interventions	1	2	3	4	5	D/K

Additional Tools

The assessment was conducted using the following tools to assess which Telehealth mechanisms individual SADC Member States currently use for Malaria, TB and HIV and AIDS surveillance and information-sharing:

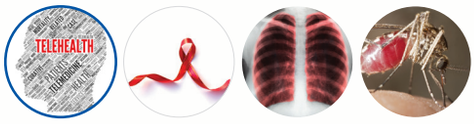
- Country situation analysis survey—desktop review and country epidemiological annual reports;
- Structured closed-ended questionnaire—to explore the potential and feasibility of Telehealth as a surveillance and information tool in the SADC region;
- Health Metrics Network country assessment tools—to assess the state of telecommunications infrastructure in terms of its readiness to accommodate Telehealth services;
- eReadiness guide—to identify the equipment currently available in Member States that can be used for the establishment of a fully functional Telehealth system for disease surveillance;
- Equipment audit tools from WHO—to define specifications for proposed Telehealth equipment;
- Tools from the International Telecommunications Union (Study Group 2—Question 14) on telemedicine in developing countries;
- Use debriefing meetings to propose how the Telehealth system can be used as an early warning system for epidemic out breaks;
- Survey questionnaire of the Africa Health Infoway undertaken by WHO and UNECA in 2007; and
- Survey tools for rapid SMS applications—to assess the human resource requirements for supporting a fully functional Telehealth system in the SADC region.
- Appropriately modified version of Rapid iHTP (WHO resource planning tool)—to draw a costed list of the equipment required for the establishment of a fully functional Telehealth system in the SADC region



ANNEX 6: ILLUSTRATIVE CONTINUING MEDICAL EDUCATION COURSES—PAN AFRICA e-NETWORK (1ST 12 ONLY)

Pan-African e-Network Project				
Schedule of continuing medical education sessions from super specialty hospitals in India for the period 01.06.2011 – 30.06.2011				
Sl No.	**Date / day**	**Time (IST)***	**Topic**	**Faculty / expert**
1	01-June-2011 (Wednesday)	14.30 - 15.30 Hrs	Enteric Fever	Dr. Sujata Aggarwal, Consultant, Preventive Cardiology Escorts Heart Institute & Research Centre, New Delhi
2	01-June-2011 (Wednesday)	15.40—16.40 Hrs	Parkinson's Disease	Dr. Geethalakshmipathy, Consultant, Neurology Apollo Hospitals, Chennai
3	01-June-2011 (Wednesday)	16.50 – 17.50 Hrs	Introduction to Positron Emission Tomography (PET)	Dr. Surya P Potharaju, HOD, Nuclear Medicine & PET CTFortis Hospital, Noida
4	02-June-2011 (Thursday)	14.30—15.30 Hrs	New Advances in GI Surgery	Dr. Rohit Kumar, Consultant, Bariatric & GI Surgery Moolchand Healthcare Group, New Delhi
5	02-June-2011 (Thursday)	15.40—16.40 Hrs	Optic Neuritis Management	Dr. Kumuduni Sharma, Additional Professor, Neuro – Ophthalmology, Sanjay Gandhi Institute of Medical Sciences, Lucknow
6	02-June-2011 (Thursday)	16.50 – 17.50 Hrs	Validating Cam Therapies in Onco Care	Dr. Raghavendra, HOD, Complementary and Alternative Medicine, Healthcare Global Enterprises Limited, Bangalore

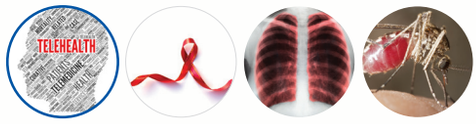
7	03-June-2011 (Friday)	14.30—15.30 Hrs	Cardiac Anatomy and Pathology	Dr. Johann Christopher, Consultant, Cardiology Care Hospital, Hyderabad
8	03-June-2011 (Friday)	15.40—16.40 Hrs	Liver Transplantation	Dr. OV Sudheer, Professor, Gastrointestinal Surgery Amrita Institute of Medical Sciences, Kochi
9	03-June-2011 (Friday)	16.50 – 17.50 Hrs	Management of Heart Failure in Children	Dr. Kiran, Consultant, Pediatric Cardiology Narayana Hrudayalaya, Bangalore
10	06-June-2011 (Monday)	14.30—15.30 Hrs	Chronic Obstructive Pulmonary Disease	Dr. GC Khilani, Professor, Medicine All India Institute of Medical Sciences, New Delhi
11	06-June-2011 (Monday)	15.40—16.40 Hrs	HIV in Pregnancy	Dr. Anita K Sharma, Senior Consultant, Gynaecology Fortis Hospital, Noida
12	06-June-2011 (Monday)	16.50 – 17.50 Hrs	Infertility (Male & Female) Part—II	Dr. Anirudha Palande, Consultant, Obstetrics—Gynecology—Infertility Dr. Balabhai Nanavati Hospital, Mumbai



ANNEX 7: LIST OF KEY PERSONS MET

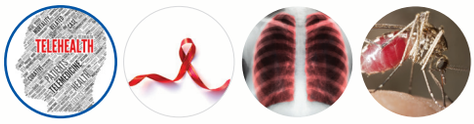
Name	Title	Tel	Email address
		Angola	
Dr. Augusto Rosa Neto	PS		
Dr. Alberto Paca Z Macosso	Director General Josina Marcel Hospital	0244 923 369700	albertopaca@yahoo.com
Dr. Nilton Savaiva	Malaria Programme		
Manzambi Ferreira	Ministry of Health, Malaria Programme		
Dr. Esperanca	International Liaison Officer		zizicorreia@hotmail.com
Dr. Ducelina Cerrano	Deputy Head, HIV	00244924 959 032	ducelinacerrano@yahoo.com
Julio Corvalho	Technical Officer, Cooperation Department	00244 925 896 609	
Isabelle Mota			
Manuel Laco			
Isilda Neves	Chefe de Departamento de Saude Publica	00244 926 64 0717	isildaneves@hotmail.com
		00244 912 94 4503	isildaneves@yahoo.es
		Botswana	
Dr. Simon Chihanga	PHS NMP	00267 363 2141	schihanga@gov.bw
			chihanga@hotmail.com
Ms Mpho Motlaleng	Ministry of Health, Malaria Programme	00267 363 2103	mpmotlaleng@gov.bw
Douglas L Shashane		00267 363 2185	dshashane@gov.bw
Lempaletse H Matenge	IT Nyangabgwe		lmatenge@gov.bw
Mosalagae Seitiso	IT Nyangabgwe		mseitiso@gov.bw
Dr. Chirenda			jchirenda@gov.bw
			chirenda1@yahoo.co.uk
Thabo Phologolo	HIV/AIDS Prevention & Care		
Tebogo Kejelepula	HCT		
Thandi Phidala	Quality Management System		
Ryan	M&E Officer: Mobile		
Tim	M&E, HIV		
Tony Liberty	Children's Hospital Paediatrician		
Scott	CDC office, Information Officer		
Dr. Chansa			
Mr. Matenge	IT Manager		
Mr. Thekiso	PMTC		
Mr. Peto	PMTC		

DRC			
Jacqueline Kachoko Kiangani	Conseillere	00243 81 5020 704	jackiekach@gmail.com
Dr. Bossiky Ngoy Belly Bernard	Conseillere Medical	00243 99 8236 098	bernardbossiky@yahoo.fr
Dr. Johnny Kalonji	Conseiller Multisectoriel	00243 81 500 3036	ricpd@hotmail.com
Dr. Beya			
Dr. Kabaye			
Lesotho			
Mr. John Nkonyana	Epidemiology		nkonyanaj@health.gov.ls
			jnkonyana@yahoo.com
Mr. Mokoena Lesenyeho	ICT	00266 5885 4454	lesenyom@health.gov.ls
		00266 2231 7707	lesenyom@yahoo.com
Dr. Maama	TB Control		
Dr. Moteetee	DG		
Me. Malerato Khoali	PS		
Nthabiseng Ntlama	Deputy TB Programme Manager		
Leutso Matsoso	Strategic Planning		
Tleberi Mpo	Planning & Policy		
Malawi			
Mr. Chris Moyo	Head of Central M&E Division		
Gibson Kapokosa	ICT, Ministry of Health	01977698 / 0888321235	gibsonkapokosa@yahoo.com
Dr. T Dzowela	Ministries Network	00265 991712 115	tdzowela@yahoo.com
Dr. Marjorie Chaponda	Technical Advisor	00265 01 789 400	mechaponda@gmail.com
Rudi Lungu			rglungu@gmail.com
Edward Chado	Epidemiology Officer	0999 586324	edchado@hotmail.co.uk
Misheck Luhanga	National Malaria Control Programme		mluhanga@msh.org
Lyson Tenthani	M&E Fellow		ltenthani@gmail.com
Relia Mandindi	IT (Pharmlite)		rmandindi@yahoo.co.uk
Dorica Chirwa	PT (Logistics Officer)		doricas@gmail.com
Andrew Dimba	DPM (MP)		adimba@wtpmalawi.org
Mr. Simon Makombe	Care & Support Officer	00265 01 788 068	doccentre@malawi.net
Dr. Noordeen Alide		08883 66786	nooralide@gmail.com
Dr. Lawrence Chiwaula		0999 551882	chiwaulam@yahoo.co.uk
Willie Samute	Secretary for Health	00265 01 789 543	willie_samute@yahoo.com
Mauritius			
Dr. Nundlall			
Dr. Jay Paul	Director, Health Services		
Dr. Poonoonsamy	Head of HIV/AIDS		
Mr. Sanjay Kumar Sobee	Assistant Secretary	00230 201 1915	ssobee@mail.gov.mu



Suraj Ramgolam	Chairman, National Computer Board	00230 210 5520	sramgolam@ncb.mu
Dalilda Allagapen	Principal Assistant Secretary	00230 201 2721	dallagapen@mail.gov.mu
Namibia			
Erastus N. Amutenya	Director, Technical & Networking Services	00264 61 205 6205	eratus@opm.gov.na
Petrus Shaama	Chief Control Officer	00264 61 203 3006	pshama@mhss.gov.za
			pshaama@yahoo.com
Mr. Van Wyk			
Dr. Florence Soroses	PMCTC Coordinator		
Mr. Salomo	ART Programme		
Mr. Hans Angula	National Waterborne Disease Control Officer	00264 661 203 5080	angula@nacop.net
Joseph Muju			
Ephanel Kimu	System Administrator		
Selvester Dalmeida			
Primus Shiluma	HMIS		primus@healthnet.org.na
Michael De Klerk	M&E		deklerkm@nacop.net
Sylvestre D'Almeida			
John Mudjuu			
Mr. Tanaka	National Database System for Malaria, TB & HIV Programme		
South Africa			
Moeketsi Modisenyane	International Relation Director, SADC		moeketsi.modisenyane@health.gov.za
Vincent Sikhakane	Deputy Director, Telemedicine		vincent.sikhakhane@health.gov.za
Mothibi Ramusi	Ministerial Advisory on Technology		
Nonkonzo Molai	DOG Technology		
Nhlanhla Ntuli			nhlanhla.ntuli@health.gov.za
Victor Mngomezulu	Head of Radiology, Johannesburg General Hospital		
Seychelles			
Dr. Cornelia Atsyor	WHO Liaison Officer		atsyorc@sc.afro.who.int
Laura Ahtime	Chief Executive Officer		laura@nbs.gov.sc
Dr. Jastin Bibi		00248 723739	Jastin.bibi@gov.sc
			jtbibi@yahoo.com
Ms. Lanka Dorby	Director General, Department of ICT	00248 286600	dgit@ict.gov.sc
Justin Frehinot		00248 783017	jusfreme@hotmail.com
Dr. Kiriabo Prosper	Director Clinical Lab, Biomedical Scientist	00248 723184	kiriaboprosper@yahoo.com
Ms. Rosie Bistoquet	Manager, Public Health Department	00248 3881222	rbistoquet@gov.sc
			rosie@seychelles.sc
Dr. Jude Gedeon	Public Health Commissioner	00248 388016	jgedeon@gov.sc

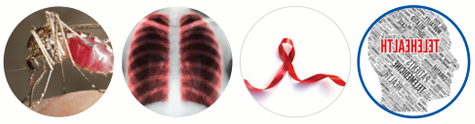
			jude@seychelles.net
Phillip Poleyne	Director Seychelles Public Health Lab		-
Swaziland			
Dr. Benjamin Gama	National Programme Officer, HIV/ AIDS		gamab@sz.afro.who.int
Mandla DS Motsa	Director, Communication	00268 404 9225	motsas@gov.sz
		00268 7606 3905	mandlanmotsa@yahoo.com
Zulisile Zulu	Chief Surveillance Officer	00268 505 2041/2	zulisilez@yahoo.com
Steven Mthethwa	Information Officer	00268 505 2041/2	it@Malaria.org.sz
Muntu C Mntungwa	Under Secretary, Ministry of Health & Social Welfare	00268 404 0654	aframuntu@yahoo.co.uk
Rejoice Nkambule	Deputy Director of Health Service (Public Health	00268 404 5554	nkambulere@gov.sz
			ree@africaonline.co.sz
Sandile Khumza	Researcher M&E, TB Programme		
Neo Dlamini	Global Fund		
Mduduzi Dlamini	Data Clerk		
Lindiwe	Regional TB Coordinator		
Sifiso Morrison Mkhonta	WHO M&E Officer Documentalist		
Zanele Simelani	Strategic Information		
Zanele Dlamini	Researcher		
Nhlanhla Mhlabathe	Epidemiology		
Tanzania			
Dr. Mohammed Ally	Medical Epidemiologist, MOHSW	00255 787 292393	mahd67@yahoo.com
Dr. Rugola Mtundu	Epidemiologist TB Programme	00255 683 312294	rugorugo@yahoo.com
Dr. Vida Mmbaga	Disease Surveillance Officer, MOHSW	0754 760732	makundiv@yahoo.com
Happy D Mariki	Assistant Project Coordinator for Telemedicine		happy@moh.tz
			shose6@gmail.com
Mr Sunday A Morabu	IT Manager	00255 27 250 4752	morabu@elct.or.tz
			morabusunday@yahoo.com
Dr. Mwendwa			
Sinza Maduka			
Mr. Rubona			
Mr. Claudi			
Happy Malik	IT		
Farician Lubanza	IT Technician		
Dr. Peter Mmbuji	Assistant Epidemiology for Disease Control Director		
Zambia			
Peter Mwaba	Permanent Secretary	00260 211 252982	ps@moh.gov.zm



Dr. Reuben Kamoto Mbewe	Deputy Director, Public Health & Researcher	00260 211 256920	rmkamoto@hotmail.com
			rkmbewe@moh.gov.zm
Noel M Masese	Head, ICT	00260 211 253040	nmasese@moh.gov.zm
			masese@mail.com
Dr. Christopher Simoonga	Director, Policy & Planning	00260 211 253053	simoongachris@gmail.com
			csimoonga@moh.gov.zm
Nchebe Sindaza Chitashi	Chief Medical Imaging Officer	00260 211 254414	nchebec@yahoo.com
Andrew Kashoka	Principal ICT Officer	00260 955 104708	andrewkashoka@gmail.com
			akashoka@moh.gov.zm
Brivine Munkombwe Sikapande	Senior IT Officer	00260 211 253053	bsikapande@moh.gov.zm
Richard Tuneo	IT Officer		
Innocent	ICT Officer		
Mozala Kanyange	Epidemiologist		
Dr. Clement Gondwe	Virology Lab Manager		
Dr. Kasonka			
Zimbabwe			
Dr Gerald Gwinji	Permanent Secretary	00263 4 789537/60	ggwinji@gmail.com
Dr. Owen Mugurungi	Director, HIV & AIDS		
Dr. Joshua Katea	Acting Deputy Director, NHIS		
Mr. Bara Edward	Chief Accountant		
Mr. John Moyo	ICT Manager		
Dr. Vera	CEO Harare Central Hospital		

SADC Secretariat

1. Dr. Ityai Muvandi, Project Adviser
2. Paul, Data manager
3. ICT Manager



ANNEX 8: LIST OF REFERRAL HOSPITALS

Angola
Jocina Macel Hospital, Luanda
Martin Fernandes Cardiology Clinic

Botswana
Franscistown Hospital

DRC Congo
Teaching hospitals in Kinshasa, Kisangani, Lubumbashi and Bukavu (secondary data)

Lesotho
Queen Elisabeth Hospital, Maseru

Malawi
Kamuzu Hospital

Mauritius
Sir Seewoosagur Ramgoolam National Hospital, Port Louis

Mozambique
Hospitale Centrale

Namibia
Windhoek Central Hospital

Seychelles
Seychelles Hospital

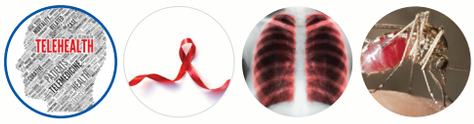
South Africa
Johannesburg General Hospital
Steve Biko Academic Hospital, Pretoria

Swaziland
Mbabane Hospital

Tanzania
N/A

Zambia
N/A

Zimbabwe
Harare Central Hospital



ANNEX 9: LIST OF REFERENCE LABORATORIES VISITED

Angola
Jocina Macel Hospital

Botswana
Francistown Hospital

DRC

Lesotho
Queen Elizabeth Hospital

Malawi

Mauritius

Mozambique

Namibia
Windhoek

Seychelles

South Africa

Swaziland

Tanzania

Zambia

Zimbabwe
Harare Central Hospital

Direcção de Desenvolvimento Social e Humano
e Programas Especiais
Secretariado da SADC

Private Bag 0095
Gaborone, Botswana
Tel: (267) 395 1863
Fax: (267) 397 2848
Email: registry@sadc.int
Website: www.sadc.int

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