

## **Country Case Study for e-Health South Africa**

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## **Executive Summary**

South Africa is a country of 48 million people, 46 % of whom live in rural areas. It is divided into 9 Provinces and there are 11 official languages. It is rich in natural resources and has one of the largest and most developed economies in Africa, with a GDP of US\$218 billion. Despite this, it has an official unemployment rate of 23%, approximately 50% of its people live below the poverty datum line and 10.7% live on less than US\$1 (purchasing power parity) per day.

### **Burden of Disease**

Its people carry a disproportionate burden of disease. HIV prevalence in people 15 years of age or older is 16.6% and the TB incidence is 1%. AIDS is the leading cause of death, followed by cardiovascular disease (17%). Child mortality under the age of 5 years is 58.3/1000 births and average life expectancy is 42 years.

### **Public Health Informatics**

Health care is provided by the State, through the National Department of Health through the Provincial Departments of Health and by the Private sector. State healthcare is provided to 82% of the population (nearly 40 million people) by approximately 9,500 doctors who access only 40% of the total annual National health spend. The private sector has approximately 25,000 doctors serving 8.5 million people and accesses 60% of the national health spend. There are a wide range of health information systems with little standardization and interoperability. Telemedicine is under-developed despite government commitment.

### **Interoperability and Standards**

Interoperability is an important consideration, as the nine Provinces use five different major systems. South Africa is a member of ISO/TC 215 Health Informatics. Several standards are in use to promote interoperability and data interchange. South Africa has adopted ICD-10 as the national diagnosis coding standard. HL7 version 2.4 has been adopted as the national messaging standard in the public sector.

### **Access to Information**

Literacy of people over the age of 15 years is estimated to be in the region of 80 - 85%. It is suggested that 30% of adults are functionally illiterate. There are 11 official languages and many people who are literate in one will not be literate in the others. Internet usage is low, 109 per 1000 people and the relative cost of internet usage is about 25 times that of the USA. There is little health related material available on the Internet in 10 of the 11 official languages. Mindset Network, a closed broadcast channel has been successful in broadcasting health programming to State Hospitals.

### **e-Health Capacity Building**

There is an urgent need for capacity development in e-Health at all levels. Many health workers do not have any computer training during their basic training and those from rural schools may never have used a computer. Postgraduate qualifications are offered at two Universities. One University offers postgraduate qualifications in telemedicine.

### **Electronic Health Records**

Only a third of all Provincial Hospitals have some form of functioning electronic medical record system. There are several systems in place and they are not necessarily interoperable. The National DOH has recently awarded a contract for the development of a National e-Health Record which will include the requirement to provide interoperability with legacy systems. Multiple systems also exist in the private sector. The National project does not look to link with any of the private sector systems. One Province is about to launch a smart e-Health Smart Card following a successful pilot project.

### **Mobile e-Health**

The South African telecommunications market is the largest in Africa totaling US\$25 billion in 2006, but South Africa continues to descend down the international scales of competitiveness and e-readiness. Broadband penetration is low and bandwidth is expensive. Mobile phones have given access to millions who were previously marginalised from personal communications and mobile phone penetration is estimated at 75%% with approximately 90% of the country covered by mobile telephony. It is likely that mHealth will play an ever increasing role in medical informatics, telemedicine, surveillance and healthcare education in Africa.

### **Unlocking the Market for e-Health**

The needs of developing countries are different to those of the developed world in some areas. International companies have come to South Africa, in some instances as global competitors, and in other as partners or benefactors. There is a shortage of people experienced in e-Health in South Africa. Local research and development in e-Health is often funded by government and undertaken by government bodies or universities. There are examples of successful innovations developed in South Africa and taken to the market place.

### **National e-Health Policies**

Several e-Governance projects have been successfully implemented in South Africa. A Draft e-Health White Paper Discussion Document has been developed. There is the potential that the proposed eHealth Policy may not achieve the goal of a policy, which is to be enabling of the activities that government would like to see flourish. There is also the chance that the goals of the policy will not be achieved, not because of lack of political will, but because to the limited human capacity and skills in the state health care sector.

### **Conclusions**

South Africa has the potential to build on its experience in e-Health and successfully move further into the field, to the benefit of its people. There is political will to achieve this. Basic enabling policy is in place for the use of ICT in eGovernance. An e-Health policy is under discussion. There are, however, major challenges: broadband penetration is low, bandwidth is expensive, many health-workers are computer illiterate, there is not a culture of data acquisition and analysis, there are too few informaticians and medical practitioners with e-health experience, insufficient people across all levels are being trained in the field, current plans do not appear to incorporate the private

sector, and there is the danger that a top down approach to implementation will be taken.

## Introduction

South Africa is a relatively large country of 1,221,037 km<sup>2</sup>, lying at the Southern tip of the continent of Africa and is bordered by six countries, Botswana, Lesotho, Mozambique, Namibia, Swaziland and Zimbabwe. The country has an estimated total population of 48.7 million people<sup>1</sup> who are almost equally divided between rural (46%) and urban areas. Its climate is generally semi-arid but is Mediterranean in the Western Cape with a sub-tropical region along the east coast.

The country is rich in natural resources, including gold, platinum, gem diamonds, coal, iron ore, manganese, uranium, nickel and phosphates. With a gross domestic product of US\$282 billion<sup>2</sup> it is one of the largest and most developed economies in Africa and accounts for about a quarter of the entire GDP of the continent. It has the 17<sup>th</sup> biggest Stock Exchange in the world. Despite this, it has an official unemployment rate of 23%<sup>3</sup>, an unofficial unemployment rate of 41.2%, with 50% of its people living below the poverty datum line with 10.7% below USD\$1 (purchasing power parity) per day<sup>4</sup>.

The region has been inhabited for generations by indigenous African people divided into a number of tribes (eg Xhosa, Zulu, Xhosi-San etc). The first Europeans settled in the Cape in 1652 and, during its early colonial history, the region was ruled consecutively by the Dutch, the British and independent Republics of settlers. In 1910, the four British Colonies at the time came together to form the independent Union of South Africa. The Union was replaced by the Republic of South Africa in 1961. From 1910 the country was successively ruled by white minority governments which, over time, disenfranchised the indigenous people. The National Party came to power in 1948 and imposed a policy of apartheid that segregated different racial groups. In 1994, the country held its first democratic and free election in which all of the population could vote and in which the African National Congress was elected.

South Africa has a bicameral Parliament consisting of the National Assembly and the National Council of Provinces. The National Assembly has 400 seats with members elected by popular vote on a proportional representation basis. Elections are held every five years. The African National Congress is the current ruling party with 69.7% of the vote (279 seats), the Democratic Alliance is the Official Opposition (12.4% and 50 seats) and the Inkatha Freedom Party (7% and 28 seats) is the only other party with more than 10 seats in Parliament. The country is divided into 9 provinces, Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North-West and Western Cape. The National Council of Provinces is made of 90 members, 10 members elected by each of the 9 Provinces and has special powers to protect regional interests, and safeguard cultural and linguistic traditions of ethnic minorities<sup>5</sup>.

<sup>1</sup> Health Systems Trust. Health Statistics. <http://www.hst.org.za/healthstats/index.php> . 1-1-2008. 6-26-2008.

<sup>2</sup> [http://en.wikipedia.org/wiki/List\\_of\\_countries\\_by\\_GDP\\_\(nominal\)\\_per\\_capita](http://en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)_per_capita)

<sup>3</sup> [www.southafrica.info/business/economy/development/lfs-280308.htm](http://www.southafrica.info/business/economy/development/lfs-280308.htm)

<sup>4</sup> World Health Organisation. World Health Statistics 2008. WHO Press, 2008.

<sup>5</sup> <https://www.cia.gov/library/publications/the-world-factbook/geos/sf.html>

South Africa has 11 official languages. Pretoria is the capital of the country, Cape Town the legislative capital and Bloemfontein the Judicial capital.

### **Health Provision**

Public health services and budgets are devolved from the National Treasury to the National Department of Health (DOH) and the nine Provincial Departments of Health with some primary healthcare services provided by municipalities. The annual healthcare spend by Government is US\$182 per capita per annum<sup>6</sup>.

There is a major inequality in healthcare funding, with 60% of the total health-spend in South Africa consumed by 18% of the population who have medical insurance and who access the private medical sector<sup>7,1</sup>. By African standards, South Africa is relatively well supplied with doctors, with 77 doctors per 100,000 people<sup>4</sup>, but again the distribution of doctors is skewed with the Provincial Hospital sector served by 24.4 doctors per 100,000 people and 9.9 specialists per 100,000 people. On average, 34.1% of the medical posts in the public health sector are vacant<sup>1</sup>.

### **Telecommunications**

The South African telecommunications market is currently the largest in Africa based on customers and revenues totalling \$25 billion in 2006<sup>4</sup>. The telecommunications landscape is dominated by the Telco (Telkom<sup>8</sup>) monopoly, and government through a process of managed liberalisation has introduced competition through the Second Network Operator (SNO) and a third cellular operator was licensed in 2002. Despite this, broadband access is hardly available and South Africa performs poorly in this vital indicator of preparedness for e-commerce.

In 2002, fixed-line penetration based on population was 10,1 per 100 people, compared with the average of 49,8 per 100 households for lower-middle-income households internationally<sup>9</sup>. Telkom's fees are up to 400% higher than the cost of similar services in 13 comparable countries<sup>1</sup>. This has resulted in the disconnection of over 850,000 telephone lines in the past few years<sup>10</sup>. Mobile has created access to millions who were previously marginalised from personal communications and mobile phone penetration is estimated at 75% with approximately 90% of the country is covered by mobile telephony.

With its existing infrastructure, South Africa has the potential to lead Africa in eGovernance and eHealth, if it can reduce communication costs and develop more enabling policy and legislation.

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<sup>6</sup> WHO World Statistics 2008

<sup>7</sup> SouthAfrica.info. Health care in South Africa. [http://www.southafrica.info/ess\\_info/sa\\_glance/health/health.htm](http://www.southafrica.info/ess_info/sa_glance/health/health.htm) . 2008. 6-26-2008.

<sup>8</sup> [www.telkom.co.za](http://www.telkom.co.za)

<sup>9</sup> Louw JA, Hanmer L. Implications of the informationi revolution for economic development in South Africa project. D19 Final sectoral report - health information flows sector, 1-53. 6-1-2002.

<sup>10</sup> Hanmer L. Overview of Healthcare Information Systems in South Africa. HISA . 6-19-2008.

## ***Public Health Informatics***

### **Burden of Disease**

South Africa faces a great burden of disease. The prevalence of HIV in adults aged 15 years or older is 16.6%<sup>4</sup> and until recently it had more HIV positive people than any other nation. Data from 2000, show HIV/Aids as the greatest cause of death (30%), with cardiovascular disease (17%), intentional and unintentional injuries (12%), non-HIV related infectious and parasitic disease (10%) and malignant neoplasms (7.5%) as the next major causes<sup>11</sup>. The incidence of tuberculosis is 1.0% and rising<sup>1</sup>.

### **Department of Health**

Public health informatics and telemedicine in South Africa are coordinated by the National Department of Health (NDOH). South Africa has a single National Department of Health (NDOH) and nine Provincial Departments of Health<sup>12</sup>. The Departments of Health in each of the nine provinces are responsible for individual health information systems and telemedicine in their province.

The NDOH coordinates the national e-Health agenda through the Directorate of Information Communication Technology<sup>13</sup> and the National Health Information System of South Africa<sup>14</sup> (NHIS/SA) (Appendix Two). The NDOH has implemented several public health information systems, notably the District Health Information System<sup>15,16</sup> and the National Electronic TB Register (Appendix Three). The department also initiated the Mindset Health Sentech Closed Health Broadcast Channel<sup>17</sup>. More recently, the NDOH has formulated an e-Health strategy for South Africa<sup>18</sup>. The e-Health discussion document explains the purpose of the national e-Health strategy in the context of problems of diseases and poverty.

A strategic framework for the implementation of an electronic health record system in South Africa<sup>19</sup> (eHR.za) has also been developed, the implementation of which was awarded to a consortium of three vendors<sup>20</sup>. The National Health Information System Directorate in the DoH is responsible for policy and regulation of e-Health as well as the coordination of the implementation of e-Health projects and programmes<sup>21</sup>.

Provincial departments also have their own e-health strategies (Appendix Four)

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<sup>11</sup> Bradshaw D, Groenewald P, Laubsher R, Nannan N, Nojilana B, Norman R, Pieterse D, Schneider M, Bourne DE, Timaeus IM, Dorrington R, Johnson L. Initial burden of disease estimates for South Africa. South African Medical Journal 2003; 93(9):682-688.

<sup>12</sup> [www.doh.gov.za](http://www.doh.gov.za)

<sup>13</sup> [www.doh.gov.za/programmes/tele-f.html](http://www.doh.gov.za/programmes/tele-f.html)

<sup>14</sup> <http://www.doh.gov.za/nhis/index.html>

<sup>15</sup> [www.doh.gov.za/department/subdir/dhis.html](http://www.doh.gov.za/department/subdir/dhis.html)

<sup>16</sup> [www.doh.gov.za/docs/legislation-f.html](http://www.doh.gov.za/docs/legislation-f.html)

<sup>17</sup> [www.doh.gov.za/docs/pamphlets/chbc.pdf](http://www.doh.gov.za/docs/pamphlets/chbc.pdf)

<sup>18</sup> National Health Information System of South Africa, National Department of Health. Draft e-Health White Paper Discussion Document.

<sup>19</sup> National Health Information System of South Africa, National Department of Health. The National Strategic Framework for her.za Implementation in South Africa. July 2007.

<sup>20</sup> [www.itweb.co.za/sections/business/2008/0803071050.asp?S=IT%20in%20Government&A=ITG&O=google](http://www.itweb.co.za/sections/business/2008/0803071050.asp?S=IT%20in%20Government&A=ITG&O=google)

<sup>21</sup> [www.doh.gov.za/nhis](http://www.doh.gov.za/nhis)

### **Presidential National Commission on Information Society and Development (PNC on ISAD)**

In building an Information Society, the Department of Health has defined e-Health as: "Combined utilization of electronic communication and information technology to generate, transmit, store and retrieve digital data for clinical, educational and administrative purposes". The purpose of e-Health is to contribute to the improvement of the health status of the people of South Africa through optimal use of ICTs. This would include e-Systems in the areas of:

- The delivery of health care;
- The surveillance of diseases and services;
- Health emergencies and hazards;
- The management of health care institutions;
- Access to repositories of knowledge, applications and literature;
- The education of the public and formal education of health service professionals.

The application of e-Health is viewed as addressing the digital divide between rural and urban populations, rich and poor, young and old, male and female people, the unequal distribution of health professionals.

The PNC on ISAD<sup>22</sup> has an e-Health portfolio and it has identified e-Health as a priority area in building an Information Society and developed a vision for eHealth<sup>23</sup>.

### **District Health Information System**

The District health Information System (DHIS) is one of the most well-established public health information systems functioning in South Africa. The DHIS was originally developed by the University of Oslo and the Health Information Systems Programme (HISP<sup>24</sup>) in collaboration with the South African National Department of Health<sup>25,26</sup>. The history and development of the DHIS has been documented by the original developers<sup>27,28</sup>. The DHIS is a user-friendly, free and open source (FOSS) application for collecting and sharing aggregated data collected at health facilities and transmitting this data to higher levels in the public health system.

Data from the DHIS are used in the District Health Barometer (DHB). The DHB, now in its third year, is a tool to monitor and support improvement of equitable and efficient provision of primary health care in South Africa by the monitoring of a selected set of socio-economic and health care indicators.. The report, which is available on an annual basis and which draws upon data from the District Health Information System (DHIS), StatsSA, the National Treasury (BAS data) and the national TB register, seeks to highlight inequities in health resource allocation, inputs, outputs and outcomes as well

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<sup>22</sup> [www.pnc.gov.za](http://www.pnc.gov.za)

<sup>23</sup> [www.pnc.gov.za/index.php?option=com\\_content&task=view&id=108&Itemid=94](http://www.pnc.gov.za/index.php?option=com_content&task=view&id=108&Itemid=94)

<sup>24</sup> [www.hisp.org](http://www.hisp.org)

<sup>25</sup> <http://www.doh.gov.za/department/subdir/dhis.html>

<sup>26</sup> <http://www.doh.gov.za/docs/legislation-f.html>

<sup>27</sup> Jorn Braa and Calle Hedberg. The Struggle for District-Based Health Information Systems in South Africa. The Information Society, **18**, 113-127.

<sup>28</sup> Braa, J., A. Heywood, et al. (1997). "District level information systems: two cases from South Africa." *Methods Inf Med* 36(2): 115-21.

as the efficiency of health processes between provinces and between all districts in the country, with particular emphasis on rural and urban (metropolitan) districts.

Currently the software is being used in all 9 provinces by approximately 200 users at various levels (i.e. sub-district, district, province, national, etc.). The national database (which has recently been upgraded to SQL Server/MSDE) contains more than 1 million patients for the period 2003 to 2005.

### **The Electronic TB Register**

The Electronic TB Register is another well-developed public health information system<sup>29</sup>. Currently, the software is being used in all 9 provinces by approximately 200 users at various levels (i.e. sub-district, district, province, national, etc.). The national database (which has recently been upgraded to SQL Server/MSDE) contains more than 1 million patients for the period 2003 to 2005.

See Appendix 3 (Case Study: The National TB Control Programme)

### **Other Government, NGO and Academic Institutions actively involved in Public Health Informatics include:**

- The Department of Communications (DOC; [www.doc.gov.za](http://www.doc.gov.za))
- Department of Science and Technology (DST; [www.dst.gov.za](http://www.dst.gov.za))
- State Information Technology Agency (SITA; [www.sita.co.za](http://www.sita.co.za))
- South African Medical Research Council (SA-MRC; [www.mrc.ac.za](http://www.mrc.ac.za))
- Council for Scientific and Industrial Research (CSIR; [www.csir.co.za](http://www.csir.co.za))
- University of KwaZulu-Natal (UKZA; [www.ukzn.ac.za](http://www.ukzn.ac.za))
- The National Health Laboratory Service (NHLS, [www.nhls.ac.za](http://www.nhls.ac.za))
- Health Systems Trust President's Emergency Plan for AIDS Relief (PEPFAR)
- Cell-Life ([www.cell-life.org](http://www.cell-life.org))

### **Conclusion**

There are wide range of relevant health informatics programmes underway. There are several concerns relating to sustainability, development of suitably trained and skilled staff to participate in and manage these programmes, and the need for the systems to be interoperable,

### ***Interoperability***

Considering the fragmented nature of the health information system in South Africa, interoperability is an important consideration. In 2002, the NHC/MIS and SITA hosted a workshop to discuss the issue and promote the concept of interoperability between health information systems. Several issues were discussed and three working groups formed dealing with: Laboratory Systems Working Group, Evaluation of the Health Information Systems Working Group and the Electronic Patient record Working Group<sup>30</sup>.

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<sup>29</sup> [www.etrnet.info](http://www.etrnet.info)

<sup>30</sup> Oumiki Khumisi , Mildred Seopa & Angie Mokgabudi. NHC/MIS Workshop Report. 8 May 2002. [www.doh.gov.za/nhis/w-shops/nhcmis\\_report.pdf](http://www.doh.gov.za/nhis/w-shops/nhcmis_report.pdf)

The SA-MRC's eHealth research and Innovation Platform is leading the Open Architectures, Standards and Information Systems (OASIS) for Healthcare project, funded by the International Development Research Center (IDRC<sup>31</sup>), developing methods and technologies for interoperability between systems.

### **Standards for Interoperability**

Several groups are working on standards to promote interoperability and data interchange and several standards have been implemented to promote interoperability between these systems<sup>32</sup>.

South Africa is a member of ISO/TC 215 Health Informatics and several ISO standards have been adopted locally. South Africa has implemented both coding standards and messaging standards. The MRC is currently under consideration for designation as a Collaborating Center for the WHO Family of International Classifications (WHO-FIC).

#### Coding Standards

South Africa has adopted ICD-10 as the national diagnosis coding standard and an extensive implementation process is underway to implement ICD-10 codes in both the public and private sectors. ICD-10 codes are mandatory when submitting claims to medical aids<sup>33</sup>. Identification of appropriate procedure coding standard(s) is also under way. UPFS is currently being used for procedures and NSN for pharmaceuticals and surgicals. There are currently no agreed standards for the coding of clinical data such as pathology, radiology or clinical terms. EPR has proposed the adoption of the LOINC codes, which are available under an "open source" license, but there has been no consensus on this as yet<sup>33</sup>.

#### Messaging Standards

HL7 has been adopted as the national messaging standard in the public sector. Version 2.4 is currently in use and there are plans to implement version 3 if and when it becomes accepted, internationally. The private sector uses EDIFACT as the messaging standard as a result of an agreement within PHISC (Private Healthcare Information Standards Committee) although there are plans to move to an XML-based standard for certain messaging requirements, although this will take some time and it does not conform to HL7 standards.

### **Summary**

Although several standards have been adopted, interoperability remains a challenge for most systems and applications.

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<sup>31</sup> [www.idrc.ca](http://www.idrc.ca)

<sup>32</sup> Lyn Hanmer and Sithara Satiyadev. Progress towards a national health information standards framework for SA: the role of PHISC (the private health information standards committee). Health Informatics in South Africa Conference, June 2008, Durban, South Africa ([www.hisa.co.za](http://www.hisa.co.za))

<sup>33</sup> Roy Alger. Status of Health Information Systems in South Africa. Electronic Patient Records (Pty) Ltd. Report, 2008.

### ***Access to Information***

Timely access to accurate healthcare information by patients, providers and researchers is a complex issue. This is especially so in a multicultural environment in a developing country, where many inequalities still exist. Various factors need to be considered and include: location, urban or rural; level of education; income; access to the State or Private healthcare system; literacy; language; computer literacy; availability of hardware; availability and cost of bandwidth; availability and cost of television access; mobile phone coverage and cost; provision and access to libraries; and the desire to want to access relevant information in order to make an informed decision about healthcare.

Approximately 46% of the population live in rural areas and seek their healthcare from either Traditional healers or allopathic medicine or both. Unemployment figures for South Africa range from estimates of 25%, based on those who are actively seeking employment, to approximately 40% when those who are not seeking employment are included. The figure of 40% is probably unrealistically high as unemployed who are active in the informal sector may not actively seek employment while generating unreported income.

The State provides about 40% of all expenditure on health but has to deliver services to 82% of the people<sup>1</sup>. This figure is calculated on the number of people in the country who do not participate in private health insurance<sup>1</sup>. So 60% of the country's health expenditure is spent on 18% of the population.

The country has 77 doctors per 100,000 people, which by sub-Saharan African country standards is high. But again there are inequalities. In the State sector, the average is 24 doctors per 100,000 people who do not have access to health insurance. This is an average, and as with any average there will be Provinces with more or fewer doctors. Three of the Provinces have fewer than 20 doctors per 100,000 people, the figure which is given by the WHO as the minimum number of doctors required to offer a basic public health service. The private sector with 25,500 doctors, services 8.5 million people giving a ratio of 300 doctors per 100,000 people. The actual figure for the private sector is probably lower and in the region of 200 doctors per 100,000, as some doctors who have left the country maintain registration in the country. There are therefore also discrepancies in workloads in the State and Private sectors and the time available to seek and provide healthcare information to patients. Doctors in the private sector are more likely to encounter patients who have researched their symptoms or condition on the Internet and are under more pressure to provide detailed healthcare information to patients.

### **Literacy and Language**

As discussed in the section on Capacity Development in eHealth, there are major inequalities in the standard of education in rural and urban areas and between State and Private schools. This has an impact on literacy. Estimates of literacy of people over the age of 15 years of age vary. The UNDP Report 2007/2008 gives a figure of 82.4%<sup>34</sup>, which is similar to the CIA factbook's 86.4%. This is a marked improvement on the 65.8% reported in the 1996 South African census<sup>1</sup>. Others suggest that 30% of adults are

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<sup>34</sup> [http://hdrstats.undp.org/countries/country\\_fact\\_sheets/cty\\_fs\\_ZAF.html](http://hdrstats.undp.org/countries/country_fact_sheets/cty_fs_ZAF.html)

functionally illiterate and that this may be as high as 50% in rural areas<sup>35</sup>. Over 4.5 million adults have either never attended school or did not progress far enough to achieve literacy.

### **Computer Literacy and Internet Costs**

The problem of literacy is compounded by having 11 different official languages and the lack of technical vocabularies for health and science in all languages. Those who are literate in one language may be, and often are, illiterate several others. Relevant healthcare information is seldom available in all 11 languages. Computer literacy is far lower than literacy because of the shortage of resources in many rural schools. Currently there are 109 internet users per 1,000 people<sup>36</sup>. Even where hardware and internet access are available, the current cost of internet use is high. 20 hours of internet access a month in the USA is calculated to be in the region of US\$15 and US\$33 in South Africa<sup>37</sup>. While this may appear to be only double the cost, per month one must consider the annual cost as a percentage of annual GDP per capita. This equates to 0.4% in the USA and 10.9% in South Africa, a more than 25 fold difference in relative cost.

The Internet may be a source of information for a few patients, but the information may not necessarily be relevant as there is little evidence based medicine reported in the African context. Patients may also not be able to evaluate the validity of the data they find on the Internet. Also, in different cultures, the need to be fully acquainted with relevant healthcare information, so as to be able to make an informed choice is viewed differently. Some believe that the healthcare provider is able to communicate with the patient's ancestors and that the healthcare provider knows about the problem and must be trusted without question.

In answer to the question, what percentage of the population is literate enough to understand preventative information on major disease, the theoretical answer is somewhere in the region of 80 to 85%. In the rural areas this may drop to 50% or less. This makes the assumption that the information is presented in a language in which the patient is literate. It is rare for information to be disseminated in all 11 official languages and so the percentage will be lower.

### **Use of ICT Resources to Communicate Basic Healthcare Information to Illiterate People**

Mindset is a partnership between the Mindset Network, the National Department of Health and Sentech, a telecommunications provider. Mindset sources and creates digital health educational content in video, computer-based multimedia and print formats in five of the 11 official languages. It is best known for its satellite based closed broadcast channel for health, which is broadcast directly to over 280 hospitals and clinics in South Africa. The receiving TV sets are usually set up in the outpatient clinic waiting room and patients watch the broadcasts as they wait to be attended to. The initial focus was on the HIV/AIDS, tuberculosis and child survival and this has recently expanded this to include sexually transmitted diseases<sup>38</sup> produced and broadcast

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<sup>35</sup> [www.projectliteracy.org.za/](http://www.projectliteracy.org.za/)

<sup>36</sup> WTU 2007

<sup>37</sup> World Bank. 2006 Information & Communication for Development (IC4D). Global Trends and Policies.

<sup>38</sup> [www.mindset.co.za/corporate/templates/about.htm](http://www.mindset.co.za/corporate/templates/about.htm) Materials

include an entertainment-education drama series aimed at young South Africa. During its first run over 13 weeks it achieved an audience share of approximately 50%. Evaluation of the series has shown that the programmes have positively affected attitudes towards stigma, HIV Aids testing and condom use. In some of the poorer areas, enlightened hospital managers have allowed local community members access to their hospitals at night, to watch these programmes.

In KwaZulu-Natal, KZ-N 22 touch screen kiosks have been introduced to provide patients with healthcare information in their own language. Anecdotal reports on the success and use of these kiosks have been mixed<sup>39</sup>.

**What are major tradeoffs between comprehensive healthcare information availability and need to communicate in local languages for target country?**

Having to produce healthcare information in 11 official languages results is expensive. This results in expedient or prudent use of available funds so as to achieve maximum exposure and penetration. Mindset is an example, producing its materials in the five most commonly spoken languages. That they have managed to achieve this in 5 languages is commendable, but this does however perpetuate and further marginalize speakers of the other six languages.

**How do researchers and providers use ICT to access health information (research, journals, databases, etc) today, and what challenges do they face?**

Researchers with access to the internet all have access to National Library of Medicine's, free Pubmed database services. This also provides access to a growing number of internet based e-journals through PubMed Central and publishing houses that make some journals or back issues of journals available at no cost. Those who have subscriptions to specific journals also have electronic full text access to the journals to which they have subscribed. It should be noted that many doctors and nurses in State hospitals have limited or no access to Internet, either because there are insufficient computers or because hospital management views internet access as a potential source of distraction which will reduce productivity. Universities, the MRC and some larger academic hospitals have access to international web based databases and also to institutional subscriptions to journals. This broadens the range of journals for which the full text of the paper can be accessed electronically. Several universities have entered into consortia to be able to share online electronic resources. Inter-library requests for full text copies of papers held in electronic format are processed more rapidly using ICTs and are often provided at no cost.

Medical libraries in South Africa face an ongoing battle to maintain adequate journal or book holdings in either hardcopy or electronic format. This is as a result of the ever increasing cost of journal subscriptions, reduced budget allocations to libraries and the general weakening of the South African currency over time. It is anomalous that South Africa, the site of much international HIV/Aids and TB research, is not able to take advantage of the WHO HINARI project which supplies free electronic access to nearly 3,000 journals and books.

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<sup>39</sup> <http://64.233.183.104/search?q=cache:ixyg0CujzssJ:www.kznhealth.gov.za/ar0506/prog1.pdf+Health+kiosk+KwaZulu-Natal&hl=en&ct=clnk&cd=2&gl=za>

## Summary

Patients, health professionals and researchers face a range of problems when trying to access accurate and relevant information. The large number of official languages poses its own problems. There is a danger of the speakers of the less used languages being marginalized and receiving less information on healthcare. Both literacy and computer literacy are obstacles. The Mindset Network is an example of successful use of ICT to get healthcare information to the illiterate.

## *e-Health Capacity Building*

“Compared to emerging economies such as Brazil and Egypt, South Africa has fewer health professionals with critical ICT skills. It is therefore relevant that South Africa should work towards health information science to produce professionals with skills to develop and drive these systems”.<sup>18</sup>

By definition e-Health requires the use of information and communication technologies by health care workers who will have to use computers to input, access, interpret and analyze information. Inequalities in the schooling system still exist in South Africa. Scholars at rural schools are most disadvantaged by the lack of, or inadequacy of, basic infrastructure at schools, and shortages of teachers, many of whom are under-qualified, especially in mathematics and the sciences. South African scholars regularly perform very poorly in international benchmarking of mathematical skills. The problems of the schooling system have an impact on the use of ICTs in the health sector.

University trained health professionals and allied health professionals will have had exposure to computers during their training. They would be expected to be able to send and receive e-mail and use the word-processing and presentation components of an Office software suite. Some may have had some training in the use of a spreadsheet but few would have had training on the use a database programme.

Nursing training is undertaken at Universities and Provincial and Private Training Colleges. Exposure to computing is limited or not available. Some Provinces have been pro-active and have sent nurses who qualified without exposure to computing on computer training courses. While well intentioned, several studies have shown that nurses often return, after training, to work environments where they are denied access to computers for various reasons, or work in settings in which computer usage is not part of their daily job requirement. Many health workers do not have, or have not been exposed to a culture of data acquisition and analysis.

There are no data available on the percentage of healthcare providers who use a computer at least once a day. It is assume that most people who work at the Inkosi Albert Luthuli Central Hospital, a paperless hospital use a computer daily. A recent paper<sup>40</sup> gives insight into the training and use of ICT by Health Information System Staff in South Africa. Of 677 respondents, 35% had received no training on the District Health Information software; 20% had less that one week of training, while 45% had training of 1

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<sup>40</sup> A National Audit of the South African Health Information System Loveday M, Smith J, Monicelli F and Karrim N. HISA 2008

week or more. Surprisingly 4% had no access to a computer and 12% did not have access to a printer. A third do not have access to email, 50% do not have access to the internet and 38% were unable to access their Provincial intranet.

### **Health Informatics Capacity Development**

Organograms of all Provincial Departments of Health make provision for Information Officers at District level and in some sub-districts and larger hospitals. The people filling these posts come from a range of backgrounds and few are trained in Health Informatics<sup>10</sup>.

There is no health informatics training in undergraduate training or in nursing training in South Africa.

Of concern is that although the Draft e-Health White Paper Discussion Document prepared by the National Department of Health has identified lack of human capacity as a problem, the National Human Resources for Health plan does not include Health Informatics capacity development and planning<sup>41</sup>. The National DOH states that it "must work with the Department of Education in developing a curriculum at school and tertiary level on computer literacy" and that, "Every health worker and administrator in the health system must be computer literate and develop high level computer skills to be able to manipulate data to provide information for managers and decision makers"<sup>18</sup>. The development of new curricula and their approval by the various registering, accreditation and funding agencies takes two to three years, so the ambitions of the Department of Health will take several years to implement, in addition the lack, or inadequacy of infrastructure at both the school level and in hospitals and clinics will take several years and substantial funding to correct.

### **Informatics Academic Programmes**

What has been done and is being done in the interim? There is growing recognition of the need for effective health information management to support health services in South Africa. To meet this need, formal postgraduate Health Informatics programmes have been developed at the University of KwaZulu-Natal, the Walter Sisulu University and the University of South Africa.

#### **University of KwaZulu-Natal**

The University of KwaZulu-Natal runs a Medical informatics programme offering PhD, coursework Masters, Masters by research only, Postgraduate Diploma and a Masters in Public Health with specialisation in Medical Informatics. The coursework and research based Master of Medical Science in Medical Informatics programmes aim to produce research oriented medical informaticians with high level computing skills. An Honours degree in Computer Science is an entry requirement. This leads to the PhD programme. The requirement for an honours degree limits the pool of available students and the first cohort of students with a Bachelors Degree in Computer Science has been registered for a Postgraduate Diploma in Medical Informatics, which comprises 75% coursework and 25% research. Successful completion of the Postgraduate Diploma can serve as an entry point into the Masters programme in the absence of a Computer science Honours Degree. Students in the Masters and Postgraduate Diploma courses are expected to

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<sup>41</sup> Hanmer HISA 2008

participate actively in projects like OpenMRC, Google Summer of CODE and OASIS. The postgraduate programmes have attracted students from four other African countries.

The Masters in Public Health with specialisation in Medical Informatics is made up of compulsory modules from the MPH programme (25%), medical informatics (25%) and research (50%). Medical informatics modules have been introduced into the Bachelor of Computer Science Honours programme to broaden the interest in medical informatics. It is felt that there need to be additional qualifications at Bachelor level to broaden the base of informaticians and that there is an even greater need to offer a series of certificate programmes for people who will be function at a lower level, capturing and managing data. The programme is also working on assisting the Eduardo Mondlane University in Mocambique to establish a postgraduate Medical Informatics programme based largely on the University of KwaZulu-Natal curriculum.

### **Walter Sisulu and Winchester University Programme**

Walter Sisulu University offers a coursework Masters in Health Informatics, in conjunction with Winchester University in England, which confers the degree and CHIRAD (UK). The emphasis of this programme is for students to “ learn the necessary knowledge, skills and understanding of the personal behaviours needed to identify the opportunities and drivers for change, select the appropriate information and communication technologies, involve perceived beneficiaries, identify the prospective benefits and successfully plan, implement and evaluate the impact of change.” A background in computer science is not required. The qualification is yet to be registered and accredited by the South African authorities.

### **Other Programmes**

A Masters level qualification in Health Informatics is under development at the University of Pretoria. The University of South Africa offers a paper based distance learning Masters in Public Health with specialization in Medical Informatics which was initially run as part of a joint MPH programme with the University of KwaZulu-Natal. The curriculum is based on that of the University of KwaZulu-Natal. Health informatics is part of the curriculum of several MPH programmes and the Biomedical Clinical Engineering programme at the University of Cape Town. Short courses are offered at the University of the Western Cape in collaboration with Stanford University and training in the District Information System is conducted by HISP. The Medical Research Council of South Africa also offers research internships and research mentoring in medical informatics.

It is felt that there is a need for a basic introductory course in medical informatics, along the lines of the Basic Telemedicine Training Course developed by the International Society for Telemedicine and e-Health. It is proposed that such a course could be offered in developing countries using an ICT based distance learning format.

### **Telemedicine Capacity Development**

The University of KwaZulu-Natal offers the only postgraduate programme in Telemedicine in South Africa, with PhD, Masters, Postgraduate Diploma and Masters in Public Health qualifications. The structure of the programmes is the same as for Medical Informatics. The entrance requirements for the Masters level qualifications are a 4 year Bachelors Degree or a professional Bachelors Degree. The programmes aim to develop competent and skilled telemedicine practitioners and managers. In conjunction with

the International Society for Telemedicine and e-Health, UKZ-N has facilitated and assisted in the development of a basic introductory telemedicine training programme that can be taught over two days. It is planned to teach this programme in several provinces in South Africa over the next year, so as to broaden the base of healthworkers exposed to telemedicine.

### **Summary**

There is an urgent need for capacity development in e-Health at all levels. While the Universities are offering advanced training there is an even greater need to train the lower level healthcare workers and information officers who will not need to have advanced computing or research skills.

### ***Electronic Health Records***

A survey of electronic medical record (EMR) applications implemented in South Africa systems has been done (Table One<sup>33</sup>) and it can be seen that slightly more than a third of the provincial hospitals have computerized systems in place. The commercial EMR market in South Africa is dominated by Meditech, Medicom and Clinicom. In general, these are large-scale enterprise hospital information systems and consist of several modules with specific functionality.

For example, in the Free State province, Meditech has an integrated patient management system (IPMS) that is implemented across the province. The application has a scheduling system and, in the Free State, links into the NHLS laboratory information management systems (DISA\*LAB) for clinician order entry.

The Patient Administration and Billing (PAAB) system developed by the National Department of Health has also been implemented in a few sites although it does not offer the same level of functionality as the commercial applications. PADS is another web-based patient registration and billing system, developed in-house in the Free State province.

*Figure one. Implementation of Commercial EMR Applications in South African Provinces<sup>33</sup>.*

<b>Province</b>	<b>System</b>	<b>Number</b>
Eastern Cape	Delta9	10
Free State	Meditech	5
	Pads	12
Gauteng	Medicom	9
	PAAB	20
	Clinicom(pilot)	3
KwaZulu Natal	Meditech	4
	Medicom	1
Limpopo	Medicom	40
Mpumulanga	PAAB	8

North West	PAAB	20
Northern Cape	Nootroclin	12
Western Cape	Delta9	25
	Clinicom	15

The Inkosi Albert Luthuli Central Hospital in Cato Manor in Durban, KwaZulu-Natal, is a state of the art paper-less hospital that has been developed as a private public partnership. While initially intended to be paperless, it is paper-less (less paper, not no paper). The Western Cape has developed an in-house primary health care application. The first module of this was implemented for HIV/AIDS patient and treatment management (Appendix Four).

In addition to the mainstream EMR hospital applications, a number of smaller systems have been implemented, particularly at smaller clinics, eg HIV clinics. For example, the Right to Care<sup>42</sup> group has implemented Therapy Edge<sup>43</sup>, a desktop application with advanced clinical decision support features<sup>44</sup> and the MRC has configured and implemented an integrated TB and HIV application using an open source EMR, OpenMRS<sup>45</sup>. Many clinics have implemented systems based on desktop productivity software such as Microsoft Access and Excel.

A significant recent development has been the tender process initiated by the NDOH for an Electronic Health Record, known as eHR.za, for South Africa. The aim of eHR.za is to create an electronic health record system in South Africa<sup>19</sup> (eHR.za) the implementation of which was awarded to a consortium of three vendors<sup>46</sup>.

In May 2004, the Free State province of South Africa initiated a provincial program to provide access to antiretroviral treatment for HIV positive patients across the province. As part of this national program, the Free State Department of Health implemented a monitoring and evaluation system for the program. Initially, this involved a system for collecting and collating data from structured medical record forms implemented across the provinces and collected on Palm Pilot handheld computers. Data was transmitted using standard telephone lines and stored in a data warehouse application<sup>47</sup>.

The SA-MRC has implemented an integrated TB/HIV patient and treatment management system at Richmond Chest hospital in Richmond, KwaZulu-Natal. The application was implemented using OpenMRS, a free and open source electronic medical record application<sup>48</sup> and the structured medical record forms created by the KwaZulu-Natal HIV/AIDS Directorate and by the National TB Control programme.

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<sup>42</sup> [www.righttocare.org](http://www.righttocare.org)

<sup>43</sup> [www.therapyedge.com](http://www.therapyedge.com)

<sup>44</sup> [http://www.ablsa.com/site/en/downloads/te\\_brochure21.pdf](http://www.ablsa.com/site/en/downloads/te_brochure21.pdf)

<sup>45</sup> [www.openmrs.org](http://www.openmrs.org)

<sup>46</sup> [www.itweb.co.za/sections/business/2008/0803071050.asp?S=IT%20in%20Government&A=ITG&O=google](http://www.itweb.co.za/sections/business/2008/0803071050.asp?S=IT%20in%20Government&A=ITG&O=google)

<sup>47</sup> Kotze, JE and McDonald, T. Challenges in Developing a Data Warehouse to Manage the Rollout of Antiretroviral Therapy in a Developing Country. IRMA International Conference, 2007, pgs 406-410.

## Conclusions

There has been significant development of EMR applications in South Africa and, in some cases, established systems across entire provinces. Nevertheless, there are still many facilities that do not have access to basic computerized facilities and electronic patient management.

## *Mobile e-Health*

“South Africa continues to descend down international scales of competitiveness and e-readiness in the telecommunications sector<sup>49</sup>.”

Despite this, the South African telecommunications market is currently the largest in Africa based on customers and revenues totalling \$25 billion in 2006<sup>50</sup>. While this may suggest that there is significant growth opportunity in the South African telecommunications market, the country faces numerous challenges to overcome the substantial inequality among its population in terms of geographic, economic and demographic distribution.

Although the telecommunications landscape is dominated by the Telco monopoly, government through a process of managed liberalisation has introduced competition through the Second Network Operator (SNO) and a third cellular operator was licensed in 2002. Despite this, broadband access is hardly available and according to the ITU 2003 comparative study, South Africa performs poorly in this vital indicator of preparedness for e-commerce. The market for Asymmetric Digital Subscriber Line (ADSL) is slowly growing with huge pent up demand and new technologies such as iBurst and 3G cellular services create new opportunities for broadband connectivity. Satellite connectivity is becoming more commercially available and Very Small Aperture Terminals (VSATs) are used in deep rural areas where fixed lines cannot reach<sup>51</sup>.

The Department of Communications (DOC) promulgated the Electronic Communications and Transaction Act (ECA) in 2002. The main purpose of this Act was to provide for e-commerce but it also included sections on e-government, the need for an e-strategy and strategies to meet universal access. The Act provides the legislative framework for the convergence of broadcasting and telecommunications infrastructures and Next Generation Networks and services.

The shift from vertically-integrated infrastructure operators to horizontal service layers is reflected in the licensing regime and is more suited to IP-based networks.

Another policy issue aimed at bringing down ICT costs is the decision taken by the South African Government to implement Free and Open Source Software (FOSS).

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<sup>49</sup> [http://www.researchictafrica.net/images/upload/SPR\\_SA.pdf](http://www.researchictafrica.net/images/upload/SPR_SA.pdf) . 1-1-2008.

<sup>50</sup> Yellowlees PM. Succesfully developing a telemedicine system. *Journal of Telemedicine and Telecare* 2005; 11(7):331-335.

<sup>51</sup> SouthAfrica.info. Health care in South Africa. [http://www.southafrica.info/ess\\_info/sa\\_glance/health/health.htm](http://www.southafrica.info/ess_info/sa_glance/health/health.htm) . 2008. 6-26-2008.

### ***Fixed Line***

In 2002, fixed-line penetration based on population was 10,1 per 100 people, compared with the average of 49,8 per 100 households for lower-middle-income households internationally [4].

This low penetration has serious consequences not only in terms of voice communication but also for internet access. Mobile has created access to millions who were previously marginalised from personal communications. The introduction of pre-paid in the late 1990s saw massive growth in the sector and mobile phones are now almost ubiquitous in South Africa with nearly 90% coverage<sup>52</sup>. Despite this, however, both mobile contract and pre-paid costs are high by international standards and impact greatest on the poor.

### **Broadband access**

While mobile is the future in terms of extending voice services, the lack of fixed infrastructure has significant implications for bridging the divide in terms of access to enhanced services and broadband. Wireless technology has helped bridge this gap. Without wireless broadband, broadband penetration would be less than half what it is now.

Even including wireless broadband in South Africa's figures, it is clear that there is an access shortfall. In terms of GDP per capita, South Africa is broadly comparable to Turkey, Mexico, Poland, Hungary and the Slovak Republic. Broadband penetration per 100 inhabitants is on average two-thirds less in South Africa than in any of these five other countries<sup>52</sup>.

The DoCs Universal Service Agency has focused on rolling out telecentres and cyberlabs and the funding of under-serviced area licensees (USALs). The telecentres have achieved little success as they seek to serve an impossibly large proportion of the population, have been very expensive to run and are not fully utilised.

The Department of Communications recognises the need for developing the necessary human resource capacity in the ICT sector. Apart from training initiatives, the department was involved with other government departments in launching the African Advanced Institute for ICT (Meraka Institute). The DoC has planned their ICT skills development strategy involving various ICT institutions.

The South African Department of Science and Technology (DST) has initiated the procurement of the South African Research Network SANREN's for broadband connectivity. SANREN's will connect to the European Commission's Géant network in Europe, and to other research networks such as Internet2's Abilene network in the USA, the Australian AARNet and the TEIN2 network in the Far East, as well as to networks and/or institutions in neighbouring countries<sup>53</sup>.

### ***Mobile***

South Africa has long prided itself on its high mobile penetration rate, which officially stands at over 30 million subscribers. Vodacom has been at the forefront of

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<sup>52</sup> Bradshaw D, Groenewald P, Laubsher R, Nannan N, Nojilana B, Norman R, Pieterse D, Schneider M, Bourne DE, Timaeus IM, Dorrington R, Johnson L. Initial burden of disease estimates for South Africa. *South African Medical Journal* 2003; 93(9):682-688.

<sup>53</sup> Cell Life. <http://www.cell-life.org/>. 2006.

technological innovation in the South African market. It was the first operator in the Vodafone group to introduce HSDPA, which allows for download speeds of around 1.8 mbit/s – comparable to what Telkom is offering on ADSL.

Vodacom's revenues from data grew by 65% between 2005 and 2006, and have grown by 149% since September 2004. Together MTN and Vodacom have over 91% of the mobile market in South Africa. Cell C's market share has declined, primarily as a result of disconnections of unprofitable lower-end customers. A comparison of coverage maps shows that Vodacom and MTN cover substantially more of the country than Cell C. For some time, both MTN and Vodacom have covered over 90% of South Africa<sup>52</sup>.

Cellular telephony is one of the fastest growing industries in South Africa and there is already a higher per capita ownership of mobile phones among Africans than in developed countries. There is much interest in mobile e-Health applications and several projects.

Cellular telephony is one of the fastest growing industries in South Africa and there is already a higher per capita ownership of mobile phones among Africans than in developed countries. There is much interest in mobile e-Health applications and several projects that have been developed.

### **OpenROSA / JavaROSA**

The OpenROSA / JavaROSA project<sup>54</sup> is a project coordinated by an international consortium of open source developers, including the MRC and Cell-Life from South Africa that aims to develop open source health data collection and management applications for mobile phones and personal digital assistants (PDAs).

### **Cell-Life**

Cell-Life<sup>55</sup> is a not-for-profit company that provides effective technology-based solutions for the management of HIV/Aids. The company is presently contributing to the development of an open source application for mobile phones and PDAs (OpenROSA/JavaROSA) with the SA-MRC and a large consortium of international open source developers. It is also currently implementing an M&E system using JavaROSA for the Community Health Media Trust (CHMT) for their 100 Treatment Literacy practitioners (who are community trainers on HIV issues) to report on their training. CHMT is supported by JHHESA (Johns Hopkins Health and Education SA), and if this pilot goes well with CHMT, it could be used by other of the 21 JHHESA partners in SA.

Cell-Life is also working on the "Cellphone for HIV", a wider project to use cell phones for mass messaging around HIV<sup>56</sup> and also the Aftercare System that has assisted the Sizophila home-based counsellors in the collection of adherence and social information on ART patients. The system has made the counsellors' jobs easier and saved them time, allowing them to care for more patients.

### **The Future**

At the connect for Africa Conference in Kigali last year, an amount of US\$55 billion was pledged for the development of mobile phone infrastructure over the next 5 years. It is

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<sup>54</sup> [www.openrosa.org](http://www.openrosa.org)

<sup>55</sup> [www.cell-life.org](http://www.cell-life.org)

<sup>56</sup> Peter Benjamin. Cell-Life, Cape Town, South Africa. Cell phones for HIV project, update June 2008.

likely that mHealth will play an ever increasing role in medical informatics, telemedicine, surveillance and healthcare education in Africa. The Meraka Institute has identified this as a research focus area in e-health in South Africa

## **Unlocking the Market for e-Health**

Matshidze and Hanmer have written a recent overview of health information systems in the private health sector from a legislative and operational perspective.

The eHealth market is growing rapidly in the developed world and is an emerging market in the developing world. As in pediatrics, where children are not just small adults, developing countries are not merely late entrants into a global market. There is a dichotomy in eHealth. The developed world, facing an ever ageing population, seeks to find ways of monitoring people with chronic illnesses in their homes, in order to keep them out of hospitals and thereby reduce health costs. In contrast the developing world, with its shortage of human and technical resources, seeks to offer scarce medical services at the hospitals and clinics nearest the patient. While the developed world looks to sophisticated hospital management systems, electronic health records and smart cards, the developing world requires cost effective, simple ways of gathering surveillance data in environments where power is uncertain and phone lines may not be available and offering specialist clinical services at a distance. These differences in needs and circumstances, provide opportunities and challenges for local business and international companies.

South Africa is a mix of the developed and the developing world. The private healthcare sector was a relatively early adopter of ICT, using ICTs for business support activities, customer service and strategy and planning activities. In a 2002 study for the Department of Trade and Industry, "increased global business opportunities" was identified as the strongest positive driver and the "general economic conditions in South Africa" the strongest negative driver<sup>9</sup>. The State sector, while embracing ICT's in health, has become fragmented. Health information systems are in operation in the different provinces that are not designed to share their data.

### **What are the challenges that private companies face?**

e-Health starts off a small base. Although it is acknowledged that there is great potential in the Market this potential is yet to be reached. There is not enough business to sustain a small or medium sized company dealing solely in e-Health. About 80% of the PACS and RIS systems in place in South Africa have been implemented by two major multinational companies through local representatives<sup>57</sup>.

The leading research groups are working on free and open source e-health solutions. There are few informaticians in South Africa and there is very limited training taking place. This limits growth of local companies and can affect the ability to tender competitively on large State projects.

The shortage of African computer scientists and informaticians makes it difficult to comply with the country's Black Economic Empowerment requirements. The relatively good general infrastructure in South Africa, when compared to other sub-Saharan

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<sup>57</sup> Dr Moretlo Molefi, Telemed Africa. Personal Communication.

Africa countries, attracts international companies to South Africa as part of global business expansion or social responsibility activities.

There is limited experienced in telemedicine. While the telemedicine market has great potential, there is significant risk associated in this field as there is little or no evidence of sustained or sustainable telemedicine programmes in developing countries. Telemedicine research is largely carried out in government bodies or academic institutions by people who are usually not experienced in taking new technologies through the regulatory processes to the market place.

Private practitioners are wary of involvement in telemedicine and the medico-legal risks involved because there are as of yet, no clear legal and ethical guidelines for the practice of telemedicine in South Africa and an early attempt set up a commercial telemedicine service in pharmacies was stopped by the Professional Council.

Developing products and systems for use in the State sector has its own set of challenges. Bandwidth is very limited, and the security aspects of the government intranet makes web based and other solutions that extend beyond the intranet impractical. Existing infrastructure is poor. Staff are largely computer illiterate. Health professionals are reluctant to use ICT solutions as they are perceived to require extra work. Support and maintenance of ICTs in State Hospitals is poor and delays in correcting faults are frequent. State expenditure on ICT in the health sector is low by developed world standards. While private health care spend is far larger, the market sector for solutions such as home care telemonitoring is small.

### **Global IT Companies**

The Provincial Departments of Health have purchased Health Information Systems from several international companies and two local companies. The local companies have been successful and in one instance have partnered other companies in a large Private Public Partnership.

International companies like Intel, SAP, Hewlett Packard, Microsoft and others are all actively involved in research or pilot projects in e-Health in South Africa and some of these projects like the Wireless Africa Projected co-ordinated locally by the Meraka Institute of the Council for Scientific and Industrial Research involve several African countries.

### **Some South African Solutions**

Several novel telemedicine associated applications have been developed in South Africa. Cell Life is a cellular telephone and internet solution to monitor HIV patient adherence to anti retroviral medication Error! Bookmark not defined.

SIMpill is a device that utilises cellphone technology and SMS text messages to monitor patients' medication compliance. When a patient opens the pill bottle to take their medication an SMS text message is sent to a central server. If the patient fails to open the pill bottle within a defined time, the server sends an SMS to the patient's cell phone and if there is repeated non-compliance, to the patient's physician.

GeoAxon is a local company researching and developing telemedicine diagnostic instruments suitable for use in the local environment.

The Medical Research Council of South Africa and the University of Stellenbosch have developed software and a computer interface for a rugged, locally designed Primary

Health Clinic Workstation which interfaces with commercially available medical diagnostic peripherals and provides video conferencing. The workstation is simple to use, has a touch screen and is suitable for use by inexperienced computer users. This is an example of extensive research and development which has not yet been commercialised. In a different economic climate this would probably have been funded by venture capital, with the formation of a new company.

The Medical Research Council and the National Defence Force have developed The Rapid Deployment Field Hospital Pathlab. This is a stand-alone unit specifically designed and based on a modified shipping container, for use in remote locations and harsh conditions. During transport it has the physical dimensions of a 6m ISO container. When functioning as a laboratory the usable floor space increases from 14m<sup>2</sup> to about 25m<sup>2</sup>, with maintenance of structural integrity and security. It can use a wide variety of communication modalities. This too is another example of local research and development that has not come to the market place.

### **Conclusions**

The needs of developing countries are different to those of the developed world in some areas. International companies have come to South Africa, in some instances as global competitors and in other as partners or benefactors. There is a shortage of people experienced in e-Health in South Africa. Local research and development in e-Health is often funded by government and undertaken by government bodies or Universities. There are examples of successful innovations developed in South Africa and taken to the market place.

## ***National e-Health Policies***

### **e-Government**

The Public Service Act gives the Department for Public Service and Administration (DPSA) the authority to determine policy and strategy on e-government and the use of ICTs within government and an e-government framework was released in 2001 and reviewed in 2005. This required every government department to develop an information management plan and strategy and suggested the creation of a Gateway portal to all government services. The DPSA also issued minimum interoperability standards. Examples of functioning e-government initiatives are eNATIS (Electronic National Transport Information System) and the South African Revenue Service's eFiling system for online income tax returns.

The Policy will aim to: strengthen the development of a comprehensive and integrated health information systems; facilitate the development of health information standards; implement security measures to safeguard the privacy of patient information inherent in electronic health records; ensure that all health care facilities have access to adequate ICT infrastructure; facilitate the development and implementation of a national telemedicine programme; develop and implement an integrated (national, provincial and local government) health promotion strategy using ICT; facilitate the development on ICT human resource strategy; develop ethical framework for the effective use of e-health by health professionals; promote e-health research and development programme.

### **A Draft eHealth White Paper Discussion Document**

A Draft eHealth White Paper Discussion Document has been prepared by the National Department of Health<sup>18</sup>. The proposed eHealth policy has four goals:

- To develop a comprehensive health information system that will ensure effective and efficient delivery and management of health care
- To improve access to health care for all and reducing inequity all irrespective of distance and location (sic).
- To ensure accessibility of health information by citizens and health care professional
- To focus on working in partnership with other stake holders to improve the quality of care at all levels of the health system, especially preventive and promotive health

Achievement of these goals will require:

- The development of a comprehensive and integrated health information systems
- The development of health information standards
- Ensuring that all health care facilities have access to adequate ICT infrastructure
- The development of a national telemedicine programme
- The development and implementation of an integrated (national, provincial and local government) health promotion strategy using ICT
- The development of an ICT HR strategy
- The development of an Electronic Health Record strategy
- The promotion of research and development in e-health for purpose of local innovation

### **Policy Considerations**

Six policy considerations were identified and strategies are proposed to address these issues. They are: security and confidentiality; increasing the efficiency and effectiveness of management and administration; access to ICT Infrastructure; standards and Interoperability; capacity building; funding and resources. Whereas previously the National DOH proposed and in some instances set up projects, these were handed over to the Provincial Departments of Health to maintain, progress and in some instances implement, the strategy now appears to be to centralise planning and implementation. While well intentioned, there is a shortage of skilled informaticians and physicians in the state sector and an even greater shortage of people with the knowledge and skills to implement new programmes. This is compounded by the lack of knowledge and support of end users. There is also the danger that the policy and its strategies are heading towards a top down approach with centralised control. The National DOH is also short of skilled staff and the comments of Yellowlees on this matter are appropriate:

*“One particular development to be wary of is the formation of centralized ‘project teams’ in health departments with the purpose of driving telemedicine. Generally, these teams lack both clinical expertise and practical telemedicine experience. They may have broad, non-specific agendas covering wide ranges,*

*specialties, needs, groups and geographical areas, and they tend to concentrate on policy before practice. They are good at arranging technical demonstrations, but are bad at promoting the actual clinical use of telemedicine. Such teams may exclude clinicians from decision making, either consciously or unconsciously, and often tend to become overconcerned about legal and confidentiality issues, probably because they do not have a good understanding of the real clinical world<sup>50</sup>.*

Some of the goals and strategies have appeared before and have not been achieved or programmes have failed. The Department also approaches the problem from the viewpoint of the State Health sector and does not take into account the successes and differing needs of the private health care system. Some examples of this:

The first of the four goals is: "To develop a comprehensive health information system that will ensure effective and efficient delivery and management of health care." The Draft e-Health White Paper Discussion Document states, "In 1995 the Department of Health through the Minister established a National Health Information System Committee (NHIS/SA) that included the nine provinces, private sector, local authority, military and medical research council, with the directive to *conceive and design a comprehensive national health information system for South Africa...*" . The National Health Act (61 of 2003) requires the development of comprehensive National Health Information Systems. The current situation is that some Provinces have components of National Health Care Management Information Systems in place. There is limited or no integration across the five different systems currently in use<sup>10</sup>. This is not a new goal and the question must be whether the Department of Health has the capacity to achieve this when it was not able to do so before.

"The development of a National Telemedicine Programme." This was tried by the National DOH and NHIS/SA in 1999 and 2000. After installation of the hardware the various services were handed over to the Provinces to maintain and expand. While aspects of the programme showed promise there was limited uptake of the project and it was not successful. There is little to suggest that circumstances have changed, as a major factor problem in the implementation of the project was the shortage of health care workers in the State sector and their reluctance to take on any additional work. A second factor was the top down approach and the lack of capacity and failure to manage change.

"Develop protocols for the practice of telemedicine". This was part of the first phase of the National Telemedicine Plan and project which was rolled out in 1999. The second and third phases of the project were not implemented because of the poor uptake of the first phase. Protocols were developed for the practice of tele-ophthalmology, teleradiology, telepathology and tele-ultrasonography. Some of these services ceased and did not necessarily follow the protocols, others such as tele-ophthalmology have evolved and follow a pragmatic protocol based on the prevailing circumstances, Services like teledermatology and telecardiology have no guidelines but services are rendered. The protocols provided for phase one of the National Telemedicine Programme were largely clinical protocols. Technical protocols were not developed. It does not appear that any attempt was made evaluate and monitor these protocols and modify them as required.

“Standardise the criteria for access to electronic medical records”. Electronic medical records of varying sophistication have been used in the private health care sector for several years.

“The DOH should set the basic standards for connectivity according to levels of care and services provided.” This was done with the National Telemedicine project and the responsibility was handed over to the Provincial Departments of Health, few of which had the capacity to adapt these standards as need arose.

The new proposed eHealth Policy appears to be re-active and not pro-active. One could argue that much of the proposed policy and strategy is based on lessons learned. Several components which appear in many eHealth policies are not mentioned or do not form part of the goals, policy issues and strategies. These include: inter-jurisdictional issues, re-imbursement, ePrescription and legislation. All of which are important.

The absence of policy relating to inter-jurisdictional eHealth matters is of concern. As there is an extreme shortage of doctors in the State health care system, 24 doctors per 100,000 people, there will be a need to seek medical services from other countries by telemedicine. The situation is worse in most sub-Saharan African countries and there is a growing expectation that South Africa will also offer telemedicine support to doctors in other countries.

### **Conclusion**

There is the potential that the proposed eHealth Policy may not achieve the goal of a policy which is to be enabling of the activities that government would like to see flourish. There is also the chance that the goals of the policy will not be achieved, not because of lack of political will, but because to the limited human capacity and skills in the State health care sector.

## **Conclusions**

### **Need**

- South Africa's burden of disease is high. There is major inequality in the provision and funding of health in the private sector and the State sector.
- The government has shown political will to achieve the goal of successfully using of ICT to the benefit of the people. Policy and legislation for eGovernance is in place and eFiling of income tax returns was implemented in 2008.

### **Experience and Potential**

- South Africa has both the potential and the need to build on its existing medical informatics and telemedicine experience, with over twenty years' experience in the use of electronic health information systems. Some coding and messaging standards are in place.
- The National Department of Health has recently awarded a contract for the development of a National Electronic Record which must be interoperable with existing legacy systems in use in the Provinces which are themselves not interoperable.

- There does not appear to be a plan to include interoperability with the established Health Information Systems in operation in the private sector.

### **Concerns**

- There is no e-health policy as yet. It is worrying that the national electronic patient record system project is proceeding in the absence of policy. It is this same lack of policy which is said to be inhibiting telemedicine uptake in the private sector, the very sector that will in all likelihood be called upon to provide telemedicine services to the under-resourced State hospitals.
- There is a Draft White Paper under discussion. This too raises the concern that National Policy is reactive and not pro-active. Reactive policy may be both parochial and meet the demands of one jurisdiction, while placing impossible obstacles in another jurisdiction.
- It would appear that control of e-health is being centralised and there is the danger that it will be driven with a top down approach.
- There is an extreme shortage of expertise in medical informatics and telemedicine in South Africa and successful implementation will need buy-in and support from all sectors. Policy planning and management decisions about e-Health or telemedicine are often made by people who are not well versed in the field.
- Future sustainability of e-health initiatives will be dependent on a growing number of well trained informaticians and telemedicine practitioners. While a start has been made, too few people are being trained. The National and Provincial Departments of Health are not addressing this.
- Currently, too many health-workers are computer illiterate and those who have had basic training may return to work environments where they do not use computers.
- The business potential of e-health for local business and scientists is not being reached.
- Deregulation of the telecommunications sector is occurring too slowly and lack of broadband penetration and the high cost of bandwidth is stifling development.
- The restrictions imposed by the government intranet will impair development of any national information system or telemedicine initiative.
- There is a general lack of change management skills in the e-health sector in South Africa.

### **Most Pressing Needs**

- Using the analogy of a jigsaw puzzle: each piece has its own place in the puzzle and solution of the puzzle requires the coming together of all the pieces, the order is not always important, some pieces fall together quite easily, others don't. Every one of the concerns listed above is a pressing need in its own right and they all need to be addressed to solve the problem.

## Predictions

- The implementation of the National Health Information Systems in South Africa will be a slow process. Health workers, especially in rural areas will find that the process involves extra work and they will become frustrated by power and technical failures and slow response times of technical support teams.
- As mobile technologies advance there will be a call to reconsider the process and there will be a growing demand to move to an open source solution that will facilitate cross border patient migration and care.
- In the absence of a long term, committed, central budget for the electronic patient record, the cost and maintenance of the project will devolve to the Provinces where it will have to compete for funding
- Telemedicine will continue to be underutilized, as the lack of an enabling policy inhibits its use by doctors in the private sector, and in the State sector, lack of an enlightened re-imburement policy to compensate for the extra work entailed in telemedicine, will serve as a disincentive. The value of telemedicine will be seriously questioned and some Provinces may consider withdrawing services. A decentralized model of telemedicine will emerge.
- Training of healthcare professionals and workers in e-health will increase but the lack of adequate ICT infrastructure and access to the infrastructure will continue to be a problem..
- The divide between the private and public sectors will grow.
- The health divide between the developed and developing world will increase until it is seen as an international problem at which stage, ICT's will be used expediently in an international model to solve specific problems in distinct areas of need.

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## Appendices

### *Appendix One – Definition of Key Terms*

<b>Abbreviation</b>	<b>Description</b>
ADSL	Asymmetric Digital Subscriber Line
DOH	Department of Health
EMR	Electronic Medical Record
ETR	Electronic TB Register
FOSS	Free and Open Source Software
DHIS	District health information System
HISP	Health information Systems Programme
HSDPA	High-Speed Downlink Packet Access
HST	Health Systems Trust
OpenMRS	Open Medical Record System
OVC	Orphans and vulnerable children
SNO	Second Network operator
VSAT	Very Small Aperture Terminals

### *Appendix Two - The National Health Information System of South Africa (NHIS/SA)*

In 1994, the Minister of Health appointed a committee comprising of the provincial Members of the Executive Council (MEC's) for Health, the Departments of Health, other relevant Government Departments, Academic and Research Institutions and the Private Sector to facilitate the development of a national strategy for the implementation of a comprehensive National Health Information for South Africa<sup>58</sup> (NHIS/SA). The underlying principles were that:

- The NHIS/SA should be nationally coordinated in order to support the effective delivery of services at all levels of the health system
- The NHIS/SA should be used to monitor the implementation and success of the health priority programmes, both of the Department of Health and the Reconstruction and Development Programme (RDP).

<sup>58</sup> [www.doh.gov.za/nhis/index.html](http://www.doh.gov.za/nhis/index.html)

- Reporting of NHIS/SA data at all levels should be timeous, accurate and complete.

The National Health Information System directorate<sup>59</sup> of the NDOH functions as the secretariat of the NHIS/SA Committee. To this end the directorate organizes and coordinates the NHIS/SA Committee meetings (see under NHIS/SA), and all its sub-committees. It also monitors and evaluates NHIS/SA Projects, including National Health Care Management Information System (NHC/MIS), Standards, Vital registration, telemedicine, geographic information systems, the departmental web site, the District health information System (DHIS, see below) and the departmental Information Center.

#### NHCMIS

- Collects and collates provincial reports on the development of the National Health Care Management Information System (NHC/MIS).
- Develop and draft provincial NHC/MIS tenders.
- Coordinates and implements the Patient Administration and Billing System - PAAB (a government developed hospital information system) in provinces.

#### Standards

- Co-ordinates development of health standards for the public sector.
- Health Data Dictionary development
- Procedure codes for the Public and Private Sectors.

#### Vital Registration

- Heads the Vital Registration project with Home Affairs and Statistics South Africa - (births and deaths).
- Conducts training in Provinces
- Develops Advocacy Material for the Project
- Evaluates implementation

#### Telemedicine

- Heads the Telemedicine Pilot Project in South Africa
- Developing Telemedicine standards.
- Guides SADC Initiatives in Telemedicine

#### Geographic Information System

- Maintaining and upgrading of the Geographic Information System.
- Departmental Web Site
- Heads the development of the Departmental Web site.

#### District Health Information System (DHIS / HISP)

- Co-ordinates and manages roll-out of DHIS
- Information Centre
- Provides Information Service to the DoH and Public

#### Departmental Web Site

- Heads the development of the Departmental Web site.

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<sup>59</sup> [www.doh.gov.za/department/clus\\_hinfo.html](http://www.doh.gov.za/department/clus_hinfo.html)

### ***Appendix Three – Case Study: The National TB Control Programme***

#### **Background**

In 1994, the South African National TB Control Program (NTP) initiated an e-strategy for managing data associated with the control of tuberculosis in South Africa<sup>60</sup>. The system has gone through several changes since its inception in 1995.

#### **TBSYS**

During 1995 and 1996, the NTP used the TBSYS application that included the following:

- Paper-based tally sheets at facility level and aggregated summaries at district level.
- Electronic systems at provincial level, comprising aggregated data collated in the MS-DOS version of the Epi Info application<sup>61</sup>.

The system provided no link between Case Finding and Treatment Outcome and also did not adhere to WHO definitions, especially regarding Treatment Outcome rates. However, it was easy to manipulate data

#### **TBReg**

In 2000, a new paper-base facility TB register was introduced that included carbonized register sheets. TBReg, a patient-based MS-DOS Epi Info application developed by the BOTUSA project<sup>62</sup>, was piloted in North West province and Mpumalanga before being introduced at (sub) district level. In 2001, approval was obtained from NHIS/SA to implement the TBReg application in South Africa and the rollout began in the KwaZulu-Natal and Gauteng provinces. In 2002, TBReg was rolled out in the Western Cape and Gauteng.

#### **ETR**

Development of the Electronic TB Register (ETR) began in 2003, based on the Windows version of Epi Info. Beta testing completed in April 2003 and the beta version was implemented in the Eastern Cape in October 2003. In December 2003, the application was migrated to the dot net platform (Microsoft Corporation) and, in 2004, rollout of the ETR.Net began in the Northern Cape, Limpopo and the Eastern Cape, followed by Gauteng, North West province and the Free State. In 2005, ETR.Net was implemented in the Western Cape and Mpumalanga.

ETR.Net is a user-friendly, patient-based application and is an Information System, as well as a Programme Management System as it provides data management tools within the system, eg:

1. Data validation checks while entering data

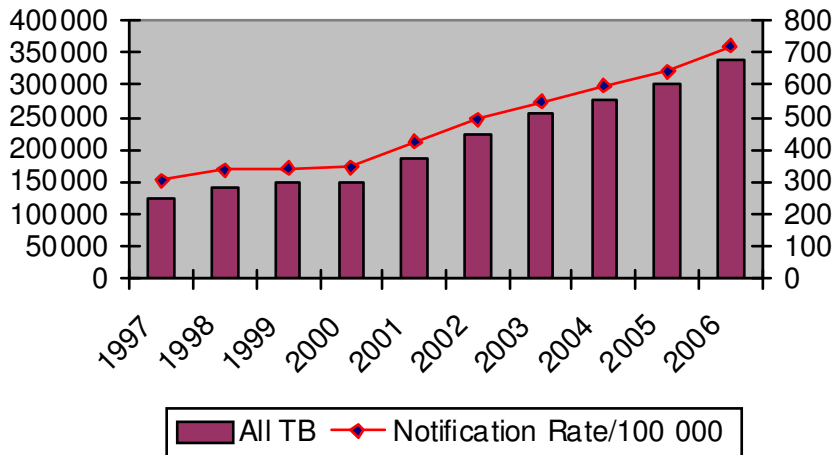
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<sup>60</sup> Carina Idema, Deputy Director: TB M&E, National TB Control Programme, South African National Department of Health. Improving TB Management in South Africa through the Electronic TB Register. Report, June 2008.

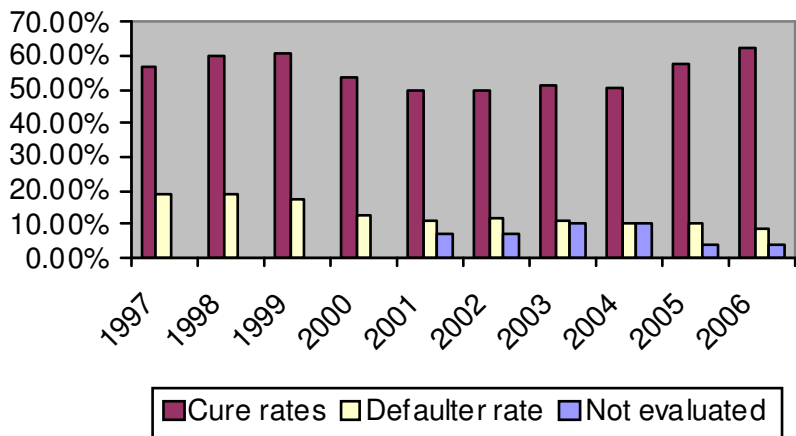
<sup>61</sup> [www.cdc.gov/epiinfo/](http://www.cdc.gov/epiinfo/)

<sup>62</sup> <http://botswana.usembassy.gov/od-cdc.html>

- a. Future dates not allowed;
  - b. Warning on dates more than 1-year ago
  - c. Warning on age >90 years
  - d. Warning if regimen is inconsistent with category and/or patient age
  - e. Warning if classification is inconsistent with sputum results
  - f. Required fields
2. (Data checks) / Programme Management listings
    - a. On-screen alerts of discrepancies between user-entered and system-generated outcomes
      - i. Patient that did not complete a full course of treatment but the user recorded Cured/Completed, the system generator outcome will be 'Not Evaluated'
      - ii. If a patient was registered as a Transfer-In. When the patient completes his/her treatment, under system generated outcome the user will get a message that the outcome will not be for this facility but that the outcome and results need to be sent to the referring facility.
3. Automated generation of standard reports using algorithms reflecting the National TB Control Programme's guidelines
    - a. Based on WHO definitions
    - b. Report generation is Cohort-based
      - i. Case Finding
      - ii. Smear Conversion
      - iii. Treatment Outcomes
      - iv. TB/HIV
    - c. Case load reports
      - i. Facility summary reports
        1. With key indicators to monitor performance
      - ii. Facility reports
4. Graphs
    - a. All TB Cases reported in South Africa 1997 – 2006



b. Key TB treatment outcomes reported in South Africa; 1997 – 2006



Many other Countries are using ETR.Net, including

- Botswana
- Namibia
- Tanzania
- Swaziland
- Guatemala
- Mozambique – been trained, is in process of implementation
- Lesotho– been trained, is in process of implementation

**Conclusion**

- Since the start of the Electronic TB Register, TB was placed on the map.
- Managers started to realise the seriousness of the disease in the country
- ETR.Net assists users and managers to identify:
  - Problem Areas/Challenges

- Identify Training needs
- Actions can be planned
- Management of TB can be improved based on facts

### ***Appendix Four – Case Study: The Provincial Government of the Western Cape e-Health System***

#### **Provincial Hospitals**

Currently, there are 50 provincial hospitals in the Western Cape, including the 3 large Academic Hospitals (Groote Schuur, Tygerberg and Red Cross) and a number of Regional (level 2), District (Level 1) and Specialist hospitals (Maternity, Psychiatry and TB).

In 1999, the Province published a tender for a Hospital Information System (HIS) for all the Provincial Hospitals (but excluding the Community Healthcare Clinics) that was awarded to Clinicom, a product developed in the United Kingdom. The application was customized extensively for the Province and the entire Billing component was developed locally. The rollout of Clinicom commenced in December 2001 at the 3 Academic Hospitals (replacing a legacy mainframe system). A centralized database architecture has been implemented and patients have a single unique identifier across all institutions (although many duplicates still exist). To date, the system has been implemented at 20 hospitals in the province and the intention is to implement it at all 50 facilities. Hospitals that do not yet have Clinicom are using the local Delta 9 product in which Each hospital has its own server and database and there is no common patient identifier across institutions.

The Clinicom system is largely an administrative system but it does contain fields for entering ICD and Procedure coding as well as discharge summaries. As part of its long-term health information strategy, the Province will implement the Clinicom Order Communications module that will greatly increase the clinical functionality of the system. When Clinicom was implemented, approximately 3.5 million patient master index records were taken over from the legacy mainframe system at the 3 Academic Hospitals (which has been running for approximately 27 years). There are now approximately 6.8 million Patient Master Index records. There are approximately 21,300 patient admissions and 188,000 Outpatient attendances per month recorded for the 20 hospitals that are on Clinicom. Figures for the Delta 9 Hospitals are not available.

A pharmacy system (JAC) was implemented at the 3 Academic Hospitals in 2000 and the roll out to all the Provincial Hospitals will commence soon. The system has also been implemented on a centralized database architecture and medication dispensed at one institution can be seen at other institutions using the system.

Health Top Management have in principle decided that the Provincial Hospitals should move to Digital Radiology. This will obviously be a very expensive undertaking. A small RIS/PACS system was implemented at Red Cross Hospital in 2003 and a tender is currently being compiled for a full scale RIS/PACS for Tygerberg Hospital (to be implemented in the 2008 Financial Year). The intention is to then roll the PACS/RIS out to the other 2 Academic sites on a centralized architecture, if this is feasible in terms of available bandwidth. The strategy for the entire Province in respect of Digital Radiology has not been fully determined yet.

Pathology is managed for the Province by the NHLS. This Province has been actively involved with the testing of a web enabled lookup system for laboratory results (WWDISA). This is currently being rolled out in this Province and will soon be rolled out Nationally.

### **Community Healthcare Centers and Clinics**

There are approximately 140 Provincial Healthcare Clinics (CHC's). An in-house system has been developed (PHCIS) that largely provides administrative support to the CHC's. The patient unique identifier is obtained (or stored) on the Provincial Patient Master Index (Clinicom) by means of web services. In this way a patient has a unique identifier across all levels of service. The PHCIS system has been rolled out to 35 sites and will be rolled out to the remaining sites over the next few years. There are approximately 1.8 million patients on the database although this does include some duplicates. The workloads recorded by the CHC's ranges from about 200 to 1000 per day.

An HIV Monitoring and Evaluation System (eKapa) has been implemented at 5 sites. It contains data for about 20,000 patients.

The Cape Unicity (Local Government) manages 86 clinics. They have implemented an Internet based system called PREHMIS at these sites. It also use web services to obtain a unique patient identifier from the Provincial PMI.

A Maternity system (CRADLE) has been implemented at 9 sites and will be rolled out further. It monitors and manages all aspects of maternity until delivery.

There are a number of other support system such as meal ordering for patients and nursing management.

### **People and Organisations involved in furthering e-Health agenda**

There are approximately 53 I.T. resources in the Health and Social Development Directorate of e-Innovation. This includes long-term contractors. The resources range from analyst/developers to Infrastructure technicians and Service Managers.

There is also a central Infrastructure component. The Province is currently obliged to make use of SITA for hosting and network services.

The Department of Health has a Directorate (Information Management) that is actively involved in the collation and analysis of Health data. They are also actively involved in the rollout of the HIS and form the core of the rollout team.

### **Private Sector Involvement in Infrastructure and Application Development**

As mentioned above the Province awarded a tender for the HIS system. The product was customized and is supported by a private company called Health Systems Technologies.

Laboratory services and systems are provided by NHLS.

### **Past and current challenges**

- Very poor service delivery from SITA
- Very low bandwidth to Health facilities
- Very expensive cost of bandwidth upgrade (monthly rental)
- Low levels of computer literacy at facilities

- Low levels of motivation to use system correctly at some institutions
- Insufficient resources (Health) to proceed with the rollouts at fast pace.

Despite all these challenges I think that we have achieved a great deal in the Western Cape.

### **Approaches used to address challenges**

Possible supplementation / replacement of SITA networking services with newer and cheaper network technologies.

### **Prospects for the future**

Completion of the rollout of HIS and PHCIS at all sites and the implementation of Order Communications with interfaces into Pharmacy, Laboratories, Blood, and Digital Radiology. This will all take some time and a great deal of effort!

### ***Appendix Five – Case Study: Videoconferencing for Postgraduate Medical Education in KwaZulu-Natal***<sup>63</sup>

KwaZulu-Natal (KZ-N) is a province of South Africa. It is approximately 98,000 km<sup>2</sup> in area, with a population of some 9.7 million people, 54% of whom live in rural areas. In the State Healthcare sector there are 28 doctors per 100,000 people and 6 medical specialists per 100,000 people. There is a high prevalence of HIV in the province and in some areas, up to 70% of women are reported to be HIV positive. The province has one medical school, the Nelson R Mandela School of Medicine, situated in Durban, a large seaport. The school has approximately 1100 undergraduate medical students and 800 doctors undergoing postgraduate medical training to become specialists in different fields. Postgraduate training is decentralized with students based at 10 hospitals in the province, the furthest of which is some 285 km from the medical school. With a shortage of skilled medical clinicians to teach medical specialties, the problem is worsened by the dispersion of students over the province.

The South African National Department of Health launched a National Telemedicine Pilot Project in 1999. In KZ-N, tele-ophthalmology and tele-ultrasonography were to be trialled. This involved installing Polycom 128, point to point, videoconference units at 11 hospitals in the Province, linked by leased ISDN lines with 256 kbs<sup>-1</sup> bandwidth. For various reasons the pilot project was unsuccessful. In co-operation with the KZ-N Department of Health (DOH) it was agreed that the infrastructure could be used for medical education. The KZ-N DOH is establishing five academic tertiary medical and academic nodes in the Province, two of which are in place with the third being developed. In keeping with this plan, videoconference units were moved to the relevant node hospitals and at three sites the equipment was upgraded to allow multipoint simultaneous videoconferencing to three or four sites and the bandwidth was increased to 384kbs<sup>-1</sup>.

The node hospitals are 85 km, 120 km, 200 km and 280 km from the medical school and the standard of the videoconference venues at these sites varies. These consist of a consulting area that can accommodate 10-12 people, a large room for 30 people, a

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<sup>63</sup> Mars M. Postgraduate medical education: Videoconferencing, a possible solution for Africa? IST Africa 2007 Conference Proceedings Eds Cunningham P and Cunningham M. IIMC International Information Management, Dublin 2007. ISBN: 1-905824-04-1.

communal-lounge dining area for up to 75 people and a lecture theatre venue seating 80. At the medical school three venues have been established, accommodating, 30, 80 and 180 people respectively. At the major postgraduate teaching hospital associated with the medical school, a multipoint facility is available in a venue for 20 people.

At each venue, the videoconference is projected on to a screen via a data-projector. Powerpoint presentations are incorporated into the videoconference using a scan converter in a computer interfaced to the videoconference unit or by an SVGA feed from the computer. Only one video-camera is used at each site and no special lighting is provided. The videoconference sessions are recorded to a VHS videocassette recorder and subsequently digitised and saved to DVD, or saved directly to DVD. Sound amplification has been installed at three of the venues and wireless microphones are used to facilitate questions and interactivity at the end of a teaching session.

Additional videoconference units have been installed in various hospitals so that there are now 37 sites in the Province, although not all are in regular use as yet.

### **Programming**

Most disciplines at the medical school run weekly postgraduate seminars, grand rounds, journal clubs and research meetings. These are scheduled on fixed days and at fixed times so as to cause as little disruption to the routine medical services in the hospital. In order to avoid any extra work in the provision of videoconferenced teaching, disciplines have elected to use their existing offerings. This has necessitated moving from their traditional venues to an appropriately sized videoconference facility.

### **Assessment**

Three of the academic programmes have been evaluated by questionnaire, completed at the end of a videoconference session or module. The questionnaires were aimed at assessing the respondent's experience with videoconferencing over several sessions and not merely the session that they had just completed.

### **Videoconference Usage**

The programme began in 2001, with one discipline involved in one hour's videoconferencing to one site, five days a week, for one semester. By 2007, 26 academic programmes were active. The expansion of videoconferencing is shown in table 1. Videoconference usage has been expressed as "person hours", where one person hour equals one person present for one hour of videoconferenced education. This is based on the Continuing Professional Education Points which healthcare professionals in South Africa have to earn on an annual basis, where one hour of tuition earns 1 point, Table 1.

*Table 1. The number of academic programmes offered each year, the total number of hours of videoconferencing undertaken each year, the total number of people involved in videoconferencing both at the local and distant sites and the number of people hours of tuition*

<b>Year</b>	<b>Academic Programmes</b>	<b>Total Hours of VC</b>	<b>Total People involved</b>	<b>Total Person Hours of VC</b>
2001	1	98	493	493

2002	2	117	680	680
2003	2	119	2,495	2495
2004	4	186	8,791	25,066
2005	6	473	15,088	58,627
2006	17	765	23,125	72,308
2007	26	886	30,256	68,846

### Assessment

Review of three of the academic programmes showed no differences in the examination and evaluation results between students at each of the distant sites and between those who attended lectures face to face and those who received them by videoconference. Fewer than 5% of respondents were negative about videoconferencing and their complaints related to the quality of PowerPoint slides. Of 68 people who delivered lectures or seminars by videoconference only 1 person felt that videoconferencing was a poor teaching tool, with 85% rating it as good or excellent.

Respondents indicated, among other things, that they felt that; more sites should be involved; it was very useful for professional development; more technical support was required on site; some lecturers needed to be trained in managing a videoconferenced session; and that this was a largely untapped resource that should be expanded.

### Conclusions

Postgraduate medical education by videoconferencing has been developed and continues to grow in KwaZulu-Natal. It has been achieved without the presenters having to do any extra work or preparation. With the current funding model of the KZ-N DOH paying the connectivity costs and maintaining its equipment and the University maintaining its equipment and supplying the academic programmes, it has become sustainable. There is a demand for such education and the potential exists to readily share this model with other African countries. The findings in our study parallel those of other authors in developed countries.

### *Appendix Six - Case Study: Telemedicine Services In KwaZulu-Natal<sup>64</sup>*

#### **Tele-dermatology Service**

The Nelson R Mandela School of Medicine at the The University of KwaZulu-Natal has been running store and forward tele-dermatology and synchronous tele-dermatology services for more than 5 years. As part of their medical studies, medical students have to undertake a rural placement for up to 6 weeks. Two students were given basic training in digital photography, provided with 4.8 megapixel cameras and asked to assist in setting up store and forward teledermatology services at two hospitals,

<sup>64</sup> Mars M: LESSONS LEARNED AT THE TELEMEDICINE COALFACE: ISSUES AND EXAMPLES FROM AFRICA. Commonwealth Health Ministers Book 2008. E-Health. Henly Media Group Ltd, London. 2008:60-63.

approximately 400 km from the medical school. During outpatient clinics at these hospitals, the students took photographs and recorded the salient details of the history and examination of patients with dermatological problems where the doctors were uncertain of the diagnosis or best treatment. In the evenings they sent the emails with attached photographs to a dermatologist at the medical school for review and advice.

In all, 48 cases were seen. There was concordance in the diagnosis of the doctors and the dermatologist in 34 cases (70%). In the absence of a telemedicine consultation, the doctors at the referral hospitals would have sent 3 of these patients on the 800 km round trip to the dermatologist for a consultation. Two of the three patients were saved the journey and were successfully managed at their local hospital.

The points which emerge from this small study are that there are relatively few instances that the rural doctors are uncertain of their diagnosis and in 70% of the cases referred for confirmation of diagnosis they were correct in their diagnosis. It is also of interest that they refer very few patients to the dermatologist.

The relatively low number of patients requiring specialist opinion is supported by the experience of a real-time tele-dermatology service by videoconference. At three hospitals in KZ-N, one urban and two rural, the doctors ask their patients who would normally have been transferred to the medical school for an opinion, to come back on a given day to attend a tele-dermatology clinic. The two hospitals each gather between 8 and 10 patients a month for these clinics. An audit of the patients seen by one dermatologist involved in the service showed that of the 223 patients seen over 2 years, 181 (71 %) were saved an unnecessary journey to the dermatology clinic at the medical school. For half of the patients referred for an in person consultation, the dermatologist was not able to make a definitive diagnosis by videoconference. The other half were sent for definitive management or further investigations not available at the peripheral site. Patients' satisfaction with the service has been high and most are pleased that they have not had to travel to see the dermatologist. The doctors participating at the peripheral sites have rated each consultation and have indicated that 86% of the consultations were of educational value to them.

### **Tele-ophthalmology**

A general practitioner who had had some basic training in ophthalmology was tasked with running the ophthalmology outpatient clinic and performing cataract surgery at his regional hospital. Frustrated by his own lack of knowledge and the need to send patients to the academic referral hospital 120 km away when he was unsure of the diagnosis or the best treatment plan, he began taking digital photographs of the surface and the anterior chamber of the eye and emailing them to an ophthalmologist at the academic hospital. In the absence of a dedicated tele-ophthalmology system, he used his own commercially available hand held digital camera, which he held to the eyepiece of a slit lamp, focussed both the slit lamp and the camera and took the picture. As there were no computers available for use by doctors at that time, he would download the images and compose the emails at home, after work and send them using his dial-up internet connection.

The success of this self initiated project led to the purchase of a Digital Ocular Capture System<sup>®</sup> which comprises a 4 megapixel camera that can be attached to any slit lamp, data base software to manage the images and email capability using Microsoft Outlook<sup>®</sup>. A digital flatbed scanner was also provided so that visual field charts and

radiological reports could be scanned and attached to emails. Photographs of CT scans were taken of the CT scanner monitor using the hand held camera when required as an attachment. Images were sent in the JPEG format and care was taken keep image file sizes below 500kb.

Referrals were assessed by either of two ophthalmologists who replied by email. Urgent cases were facilitated by telephonic discussion to alert the ophthalmologist and subsequent telephonic communication of the diagnosis and treatment options. In the first two and a half years of this service, 282 patients who would previously have been referred to the academic ophthalmology unit were dealt with by email. Of these, 50 patients (18%) required transfer for diagnosis or further management, 41 cases were deemed urgent. In only 3 instances (1.1%), was transfer requested by the ophthalmologist because the image quality was too poor to make a definitive diagnosis. Seventy-six people (27%) were given an appointment for elective/non-urgent referral, a process that would previously have required the patient to be transferred to Durban to be given the appointment for an elective procedure or consultation at a later date. In all, 232 people (82%) were saved an unnecessary roundtrip journey of 240 km.

This service which has been running for nearly 5 years can be considered a success, but attempts to replicate it in two other hospitals have failed because of workload and lack of onsite support for telemedicine. A new service using a retinal camera for both diagnosis and diabetic retinopathy screening has commenced and shows promise.

### **Conclusions**

Relatively simple solutions have been found to implement sustainable telemedicine services.

### ***Appendix Seven – Case Study: KwaZulu-Natal Tele-Health Project***

#### **Project Aim**

The aim of this project is to establish a telemedicine service to deliver healthcare to rural populations in KwaZulu-Natal, by linking hospitals to specialists based at a hub situated at the Nelson Mandela School of Medicine, Durban.

#### **Project Objectives**

1. To provide sustainable broadband access to rural healthcare centers using various appropriate technologies.
2. To provide, implement and evaluate the use of telemedicine diagnostic tools at the sites identified by the KZ-N DOH.
3. To train users and support staff in the use and maintenance of telemedicine infrastructure.
4. To develop research capacity in the field of telemedicine. The focus will be on Medico Legal issues and standards in Telemedicine.
5. To develop a telemedicine hub that will service at least 4 of the identified sites in this project and also service other sites in the province with videoconferencing telemedicine facilities.

6. To develop and implement a booking and administrative system for synchronous and store and forward telemedicine.

#### Innovative use of Bandwidth Solutions

In order to ensure the long term sustainability of the project it is important to research alternative connectivity options including satellite, wiMax, wifi, 3G, GPRS etc. The research needs to focus on solutions meeting the clinical demands in terms of bandwidth in the most cost-effective manner.

The Telecommunications regulatory policy is currently being overhauled to be aligned with new technologies and connectivity solutions are being investigated from existing incumbent operators, Sentech, Telkom, Neotel, cellular providers as well as new competitors in the market including the USALs.

It is also important to consider the social responsibility objectives imposed on each of the licensed operators in terms of telecommunication provision to schools and clinics. It is for this reason that Meraka are following a strategy partnering with the Department of Communications when engaging with service providers to ensure the best possible service at the most competitive rate.

#### Identify and / or establish suitable bandwidth options – Meraka/SITA

Discussions are underway with Neotel, Sentech, Saab/Grintek, Cisco and Telkom. A range of alternative bandwidth solutions are being investigated including Wimax, CDMA, VSAT and 3G. The bandwidth option must meet SITA requirements in terms of security (Layer 2), quality of service, affordability and user requirements. SITA KZN will be included in this planning phase.

#### Identify sites for Telemedicine implementation – KZN DoH, UKZN

As directed by the Department of health, the following sites have been identified for telemedicine implementation. These sites have been visited but other sites have also been visited in case the required bandwidth solutions are not possible yet.

- Mosvold Hospital– teledermatology, telepsychiatry teleultrasonography
- Manguzi Hospital – teledermatology service currently running, request for telepsychiatry
- Murchison Hospital - teleophthamology in progress, there is a request for a special camera, using store and forward and will investigate 3G options.
- Port Shepstone Hospital – teledermatology, telepsychiatry, 3G options
- Kokstad Hospital - A Teledermatology service has commenced (EG Usher) and they will be a send site for telepsychiatry Connectivity for 3 G will be investigated. There is a need for a dermascope.
- Rietvlei – teledermatology, telepsychiatry and teleradiology require a VSAT solution.

There has been a strong demand for telepsychiatry services from the hospitals and numerous meetings have been held. A telepsychiatry working committee has been established with the Medical School Department of Psychiatry and their staff at the receive sites at King George V, Durban and Townhill, Pietermaritzburg. Video Conferencing is required for this service and the project aim is to find suitable bandwidth solutions to these sites.

In addition to planning a clinical service via videoconferencing the project will research:

- develop clinical and technical guidelines for telepsychiatry
- conduct a benchtop assessment of teleconsultation and telepsychiatry at different bandwidths
- Establish infrastructure at receive sites

#### Evaluation of the use of different telemedicine diagnostic tools

The appropriate diagnostic tools will be identified by the doctors and evaluated using different bandwidth options.

#### Training of medical and technical staff

A basic telemedicine training programme has been developed which is to be endorsed by the International Society for Telemedicine and e-Health and training will commence when the sites have been verified and the diagnostic instruments selected. Training has begun for telepsychiatry in clinical aspects via a desktop study. Training in videoconferencing techniques has begun.

#### Development of Research Capacity

The consortium has agreed to fund 2 PhD Students whose proposals have been accepted by the University's Higher Degrees Committee. The first paper that focuses on need for ethical clinical guidelines has already been published. A Paper on the review of telepsychiatry and issues relevant to the developing world is being prepared. Ethical approval for a study on doctors understanding of ethical issues in telemedicine is awaited as is an ethics application for study on cell phone use and availability in rural communities with respect to use of cell phones in telemedicine, In addition a paper on ethical and legal issues relating to tele-psychiatry in the developing world being is being researched. A study on radiology needs assessment is being prepared.

A benchtop study on different bandwidth requirements for telepsychiatry will be planned.

Masters students are working on draft guidelines for:

- Telepsychiatry
- Teletraumatology
- Telepsychology
- Teledermatology
- Teledentistry

An internationally validated eReadiness survey has been approved for use in KZ-N Hospitals and a Masters student will be conducting an eReadiness assessments at 4 sites in KZ-N. A PhD Student will conduct an eReadiness assessment of the 3 Area Managers and 11 District Managers.

#### Development of a telemedicine Hub

The telemedicine hub will be at the Nelson R Mandela School of Medicine at the University of KwaZulu-Natal.

### Develop a Booking & Administration system

The project team consortium is working with the KZN Department of Health towards a teleradiology strategic plan in the Province to enable use of teleradiology in this project. Several meetings held with radiologists, procurement division, revitalisation team, and vendors.

### ***Appendix Eight – Case Study: Web-Based Information Dissemination***

The MRC maintains two web-based resources for health information dissemination: SA HealthInfo<sup>65</sup> and AfroAIDS Info<sup>66</sup>.

SA HealthInfo is a research knowledge translation tool and service to support innovation and improved decision-making in Southern African health sectors.

AfroAIDSinfo is a web-based information portal that provides up-to-date, scientifically accurate information on the Human Immunodeficiency Virus and Acquired Immunodeficiency Syndrome (HIV/AIDS) with a specific focus on the Southern African region. The portal is divided into five sections, to cater for five consumer groups:

- Science - gives the latest scientific research and statistics and is aimed at researchers and scientists
- Health profession - provides information on prevention, treatment and care, including a focus on women; as well as matters affecting the health care professions
- Policy - includes information on government responses
- Education - provides resources for educators and learners
- Public - includes general information on HIV and AIDS and community initiatives

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<sup>65</sup> [www.sahealthinfo.org](http://www.sahealthinfo.org)

<sup>66</sup> [www.afroaidsinfo.org](http://www.afroaidsinfo.org)