Ministry of Health

B.P. 84, KIGALI, RWANDA
Phone: +250-577458
Fax: +250-576863

THE NATIONAL E-HEALTH STRATEGIC PLAN 2009-2013

By Richard Gakuba, MD, MSc
National e-Health Coordinator

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Name	Position	Department/Ministry
Dr Richard SEZIBERA	Honorable Minister	Ministry of Health
Dr Agnes BINAGWAHO	Permanent Secretary	Ministry of Health
Dr Steven KARENGERA	Director UPDC	Ministry of Health

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Executive Summary

The e-Health Strategic Plan is a directional document that describes Rwanda's long-term vision for e-Health, with a strong focus on tangible benefits and deliverables for the next five years. It also describes the leadership and governance structure, centered on the e-Health Steering Committee that will help ensure the timely completion of e-Health initiatives.

A concise definition of e-Health: *The Use of Information and Communications Technologies to Provide and Support Healthcare service delivery.*

This document fulfills one of the key tasks of the e-Health Steering Committee – to define a strategic plan for e-Health in Rwanda, including a clear vision of what the existing and future systems will look like over the next five years, what needs to be done to attain that vision, and the role of the different stakeholders in ensuring the successful implementation of all e-Health initiatives.

Rwanda's health sector policy and challenges

Rwanda covers an area of 26,338 km² and currently has a population of over 9 million, of which 45 percent are under 15 years of age. The population density is 329 inhabitants per km², one of the highest in the world. Most of the inhabitants (85%) live in rural areas. The annual population growth rate is 2.6% and the fertility rate is 5.5. Life expectancy at birth is currently estimated at 49.4 years for men, 53.3 for women and 51.4 years for the entire population.

The economy has recovered strongly since the war that took place between 1990 and 1994, and the genocide which claimed over one million people. There has been steady economic growth of over 10 percent on average annually since 1996 and inflation has been kept to a low level.

However, key socio and economic pressures are currently combining to threaten the improvement and sustainability of our mainly publicly funded healthcare system. Some of these pressures are:

- Shortage of healthcare professionals that threatens to extend the already existing long waiting lists for some healthcare services and unavailability of such specialized services to the majority of the population

- Epidemics such as HIV/AIDS and Malaria

- Limited access to health facilities due to poor infrastructure

- Inefficiencies of the healthcare system

- Extreme poverty (41.3% of the population)

The Response

There is agreement across Rwanda's policy makers that e-Health is vital to an effective, sustainable health system that will stand up to present and future challenges.

The National Information and Communication Integration (NICI) document committed the Government of Rwanda to an integrated ICT-led socio-economic policy and plan. In line with this plan the Ministry of Health is committed to the deployment of ICT in order to contribute to this social development. In view of this policy and plan the Ministry of Health was mandated to facilitate the implementation of e-Health systems which are geared towards the improvement of healthcare service delivery.

E-Health will be key to transforming and enabling the sustainability of Rwanda's healthcare system. It supports an environment with integrated services to efficiently deliver high-quality and coordinated healthcare services

The Ministry of Health has established the e-Health Steering Committee to accelerate the development and implementation of e-Health systems for the country. The e-Health steering committee proposes the establishment of am e-Health Department which will be comprised of a skilled team of people that will spearhead the planning and implementation of e-Health initiatives.

The Mission

The mission of the Department of e-Health is to provide and maintain highly effective, reliable, secure, and innovative information systems to support clinical decision making, patient management, education and research functions of the health sector in Rwanda in a bid to improve healthcare service delivery.

The Strategy

The e-Health steering committee has set the following key strategic tasks and priorities for the Department of e-Health has, which will guide the department to implement and realize Rwanda's vision for e-Health.

- Developing the overall business architecture for the e-Health system;
- Engaging with stakeholders across the country to gain their participation in building awareness of the e-Health strategy and activities;
- Leveraging available financial resources and sourcing for extra funding;
- Developing detailed implementation plans for e-Health strategies;
- Designing the architecture for an integrated e-Health system and setting standards for e-Health systems;
- Safeguarding privacy and security for health information;
- Setting strategies and evaluation measures for the e-Health Department;
- Making a governance and accountability model that will allow e-Health to be managed in a way that delivers on the government's goals of transforming the healthcare system in a coordinated and integrated way;
- Conducting external reviews of e-Health initiatives to ensure that they are following best practices when it comes to project governance, charters, and other critical elements;
- Identifying other policy or regulatory recommendations to ensure that no unintended hurdles remain that might get in the way of e-Health initiative implementation.

Resources

The Government of Rwanda through its Ministry of health is investing considerable resources to attain its e-Health vision. The Ministry of Health and its partners, under the guidance of the e-Health Steering Committee, are committed to investing in e-Health initiatives. In close cooperation with its partners the Ministry of Health is optimistic that the necessary funding for the e-Health strategies will be obtained.

Key Benefits

The key benefits which are envisioned through a comprehensive e-Health strategy are:

- Enhanced healthcare service availability and access;

- Improved healthcare quality, safety and outcomes;

- Increased service efficiency, productivity and cost effectiveness that satisfies citizens, patients and providers;

- Improved teaching methods facilitated by e-learning systems

- Provision of evidence based information required to make appropriate, timely and informed clinical decisions concerning patient care;

- Provision of more comprehensive reports that enable better informed decisions in health service planning.

- Improved distribution and usage of medical supplies

- Improved financial accessibility to healthcare services

Transforming Clinical and Business Practices

A detailed elaboration of targeted e-Health service elements is further described later in this document but these service elements include:

- Community Health

- Primary Care (Health records, pharmacy and laboratory)

- Hospital Care (Diagnostic, surgical, emergency and tertiary care)

- Population and Public Health (health surveillance, public health reporting etc.)

- Drug procurement and tracking (Inventory management, medication profiles and prescribing, etc…)

- Blood bank

- E-learning

- Healthcare financing (Healthcare insurance)

- Integration with the National electronic Identity Card

Important remarks

- Successful implementation relies on collaboration of all stakeholders

- In order to ensure continuous improvement and avoid unnecessary duplication of effort, partnerships will be made with various organizations.

- The implementation of the e-Health systems is not an IT project. The primary focus of attention should be on the health care pathway change aspects and overall healthcare service delivery, and not the technical implementation activities…not the networks and servers, etc…

- It is important not to underestimate the skills gap between the IT skills and confidence currently in place compared with what may be required. A vigorous training program will have to be put in place.

In Conclusion

The time is right to fully commit to and move forward with the National e-Health strategy. The leadership is aligned, some resources are committed, and the benefits to the overall health system in Rwanda make the implementation of paramount importance.

The implementation of e-Health enables significant progress towards improved continuity and coordination of care, easy access to healthcare services, early detection of disease and illness, and better information on healthcare needs and outcomes.

Progress in these fundamental areas will move Rwanda closer towards having a health system that is sustainable, affordable, publicly funded and delivering excellent quality healthcare to its citizens.

A broad spectrum of e-Health projects have been planned with the common goal of having an integrated, interoperable e-Health system that spans and supports the entire

continuum of care across all of the many settings and locations where healthcare is provided and accessed.

Over the next five years, key projects will be implemented. The implementation of these e-Health projects will enhance current care processes and, more importantly, will transform clinical and business practices enabling improved quality of care.

Introduction

Purpose of Document

The e-Health Strategic plan is a directional document that presents a high-level plan to develop and implement e-Health in Rwanda. It describes Rwanda's long-term vision for e-Health with a strong focus on the tangible benefits and deliverables that will be achieved over the next five years. The strategic plan also describes the leadership and governance structure that will be put in place to guide the implementation, and help ensure the timely completion of e-Health deliverables and realization of the associated benefits for Rwandans. In a nutshell, it is a high-level plan to develop and implement e-Health in Rwanda.

The document presents the e-Health Strategic Plan in three parts:

- **Part One: e-Health – Enabling a Sustainable Healthcare System**

- **Part Two: Benefits of e-Health**

- **Part Three: Implementation Strategy**

This document is presented by the e-Health Coordinator and fulfills one of the e-Health Steering Committee key objectives– to define a strategic plan for e-Health in Rwanda, including a clear vision of what the initial e-Health systems will look like over the next five years, what needs to be done to realize that vision, and the role of the Department of e-Health in ensuring the successful implementation of e-Health. The scope of work and functions of the Department of e-Health is detailed in part three of this document and **Annexure A** is a diagrammatic representation of the proposed e-Health organic structure.

Definition of e-Health

In Rwanda, the Ministry of health defines e-Health as – *The Use of Information and Communications Technologies to Provide and Support Healthcare service delivery.*

This definition encompasses an integrated set of information systems that enable the following:

- Efficient delivery of healthcare services over the full continuum of care through the provision of integrated, interoperable health information systems, tools and processes;

- Transformed health sector decision-making culture into one that is firmly supported by accurate, timely and relevant information in a manner that protects individual privacy, respects clinical practice requirements and sustains the long-term viability of the healthcare system; and

- A clearly defined architecture and standards for integrated and interoperable e-Health systems with defined standards.

Part One: e-Health – Enabling a Sustainable Healthcare System

This section summarizes the key challenges in healthcare service delivery, and describes the government's e-Health related response to these challenges. It articulates Rwanda's e-Health vision and strategies for implementing e-Health.

1.1 The Challenge – A threat to the improvement and sustainability of the Healthcare System

Health challenges remain one of Rwanda's major constraints to poverty reduction and quality of life improvements as well as to overall economic growth and development. Although great strides have been made through the efforts of Rwanda's Reconstruction Program in re-establishing health sector infrastructure post the 1994 genocide, current health indicators show the desperate need for additional strategies to address current issues. Rwanda continues to have one of the highest child mortality rates in the world at 103 deaths per 1,000 children under the age of five. Maternal mortality is also unacceptably high at 750 per 100,000 live births.[1] Healthy life expectancy at birth is estimated at 51.4 years for the entire population[2], demonstrating the reversal of gains made previously due to economic crises, conflict and instability.

Communicable diseases continue to take their toll, malaria being responsible for the largest share of morbidity and mortality followed by acute respiratory infection and diarrheal diseases, targeting the youngest section of the population. HIV/AIDS and its escalating links to tuberculosis are is one of the threats to public health.

Rwanda currently lacks an adequate number of qualified health personnel to address these increasing health challenges. The doctor to inhabitant and nurse to inhabitant ratios are 1:18,000 and 1:1,690 respectively. Those health personnel currently serving the population are often concentrated in more urban environments. Rwanda must both increase its supply of qualified health personnel and ensure that their services reach those in need, primarily in the rural areas. Rwanda's national health policy strategy identifies two priority interventions along these lines: a) improving the availability of well-

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[1] Rwanda interim DHS 2007-2008
[2] INSR: 3ème RGPH 2002; projections de la population: Hypothèse moyenne

qualified health professionals throughout the country, particularly in rural and other poorly served areas; and b) increasing geographical accessibility of health services.

The challenges facing the health system are daunting and have a potential compounding effect between them. For example, poor people require more care per capita. Therefore, having a large percentage of the total population, especially in rural areas where the rate of poverty is high, will increase the demand for care, while constraining the traditional tax base and foreign funds used to fund that demand.

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<u>Key indicators</u>

- *Population density: 329 inhabitants per km²*
- *85% of inhabitants live in rural areas*
- *Annual population growth rate is 2.6%*
- *Healthy life expectancy at birth: 51.4 years for the entire population*
- *Real GDP per capita: 292 US dollars*
- *56.9% of population below the poverty line*
- *41.3% of population in extreme poverty*
- *Child mortality rate 103 deaths per 1,000 children under the age of five*
- *Maternal mortality: 750 per 100,000 live births*
- *HIV average prevalence rate: 3%*
- *Malaria prevalence: 2.6% children under five and 1.4% for women*
- *Tuberculosis annual infection risk: 2% in 2005*

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Figure 1. Key healthcare indicators for Rwanda

1.2 The Response – Investing in e-Health to ensure improvement and sustainability

Rwanda has witnessed a profound transformation in how services are delivered in other sectors such as financial, communications and hospitality services within and outside the country. Information management and technology have helped these sectors achieve substantial increases in productivity over the last few decades. If the forecast pressures on the healthcare system are to be successfully managed, it is essential that proven innovations in information technology be adopted and similar improvements in effectiveness, efficiency and productivity be achieved in the health sector.

All government institutions that have healthcare in their mandate are united in assuring a sustainable improvement in Rwanda's healthcare system. The Ministry of Health has been designated as the principal Government agency responsible for health sector development.

The recent creation of the Rwanda Biomedical Center which merges all Government institutions that contribute to healthcare service delivery can only be a positive initiative since it will facilitate integration of e-health systems under one leadership.

1.3 Vision, Mission and Values

Vision

The vision of the Department of e-Health is to have an effective infrastructure, applications and information systems supporting effective and efficient delivery of healthcare services in Rwanda.

Mission for e-Health

The mission of the Department of e-Health is to provide and maintain highly effective, reliable, secure, and innovative information systems to support clinical decision making, patient management, education and research functions of the health sector in Rwanda in a bit to improve healthcare service delivery.

Values

Service to the public: Strategy and priorities will be based upon the fundamental goals of healthcare service delivery.

Efficiency and cost-effectiveness: The Department of e-Health is committed to achieving highest efficiency at all levels of healthcare with minimal investment.

1.4 Strategy to attain Rwanda's e-Health vision

The ultimate success for e-Health depends on strong leadership, effective collaboration and well-managed implementation. The Department of e-Health will assure the following:

- Developing the overall business architecture for the e-Health system;
- Engaging with stakeholders across the country to gain their participation in building awareness of the e-Health strategy and activities;
- Leveraging available financial resources and sourcing for extra funding;
- Developing detailed implementation plans for e-Health strategies;
- Designing the architecture for an integrated e-Health system and setting standards for e-Health systems;
- Safeguarding privacy and security for health information;
- Setting strategies and evaluation measures for the e-Health Department;
- Making a governance and accountability model that will allow e-Health to be managed in a way that delivers on the government's goals of transforming the healthcare system in a coordinated and integrated way;
- Conducting external reviews of e-Health initiatives to ensure that they are following best practices when it comes to project governance, charters, and other critical elements;
- Identifying other policy or regulatory recommendations to ensure that no unintended hurdles remain that might get in the way of e-Health initiative implementation.

1.5 In Conclusion

Rwanda is investing considerable resources to realize its e-Health vision. The Ministry of Health, the health authorities and the provider community, under the leadership of the e-Health Steering Committee, are committed to moving forward with a coordinated and visionary approach to implementing e-Health in Rwanda.

The long-term National vision for e-Health and the priorities for the next five years are established and have been described in the first part of this strategic plan. The next section of this document describes, in detail, the benefits targeted through the implementation of this comprehensive e-Health strategy.

Realizing the benefits and attaining the vision for e-Health requires the ongoing engagement of all key stakeholders as well as a focused commitment by stakeholders to align their individual plans with overall National e-Health priorities. E-Health is critical to enabling the transformation of the health system, required to address the impending challenges and achieve a sustainable health system for future generations of Rwandans.

Part Two: Benefits of e-Health

A modern and effective health system needs accurate, relevant and accessible information. Timely information is vital for improving care for patients, improving the performance of the health system and improving the health of Rwandans. In the final analysis, the value of moving forward with e-Health is how well e-Health enhances the delivery of health services to individual Rwandans.

2.1 Key Benefits

The Department of e-Health will aim at achieving both quantifiable financial benefits and significant qualitative benefits through e-Health initiatives.

The key benefits to be achieved through a comprehensive e-Health strategy are outlined below:

- Enhanced healthcare service availability and access;
- Improved healthcare quality, safety and outcomes;
- Increased service efficiency, productivity and cost effectiveness that satisfies citizens, patients and providers;
- Improved teaching methods facilitated by e-learning systems
- Provision of evidence based information required to make appropriate, timely and informed clinical decisions concerning patient care;
- Provision of more comprehensive reports that enable better informed decisions in health service planning.
- Improved distribution and usage of medical supplies
- Improved financial accessibility to healthcare services

E-Health can significantly and positively change the way health services are delivered in Rwanda. The key benefits outlined above will be demonstrated by:

- Patients having access to safer, higher-quality healthcare services enabled through the timely availability of their personal medical information and best-practice information to their care providers;

- Care providers having the necessary, accurate information required to make appropriate and timely clinical decisions concerning patient care and public health protection; and

- The health system as a whole having improved access to more comprehensive information, which will enable more informed health service planning and result in increased efficiencies.

A more complete list of the benefits that will be realized by the public/ patients, care providers, as well as the overall health system through the implementation of e-Health is outlined in Table 1 below:

For the public and Patients	For the care providers	For the overall health system
Improved care outcomes	Improved care outcomes	Improved care outcomes
Proper care, more easily and readily available	Better access to clinical information	Care coordination improved across continuum
Support for improved public health protection	Timelier sharing of information with other providers	Need for travel reduced
Health Information travels with the patient	Less duplication of diagnostic tests	Cost savings less- burden to limited resources
Reduced travel costs	Availability of clinical information support tools	Better population health and protection
Improved availability of specialized services	Easier coordination of care interventions with other care providers	More effective health planning
Improved access to education facilities and resources	Greater practice efficiency	Health System more cost effective and sustainable
	Ability to reach many with no travel risks and costs	Improved education/training methods

Table 1. Benefits of e-Health

2.2 E-Health — enabling the transformation of clinical and business practices

This section examines in more detail the tangible benefits that will be realized as a result of completing the clinical and non-clinical e-Health projects described in Part Three – Implementation Strategy.

In addition to considering the projects and their benefits from the perspective of clinical and non-clinical support, e-Health projects and benefits can also be examined from the perspective of the commonly encountered health service components or operations that they involve or impact.

These e-Health components include:

- Community Health

- Primary Care (Health records, pharmacy and laboratory)

- Hospital Care (Diagnostic, surgical, emergency and tertiary care, telemedicine, etc.)

- Population and Public Health (health surveillance, public health reporting etc.)

- Drug procurement and tracking (Inventory management, medication profiles and prescribing, etc…)

- Blood bank

- E-learning

- Healthcare financing (Healthcare insurance)

- Integration with the National electronic Identity Card

The figure below highlights the key components of healthcare delivery (shown in the form of major pillars) that will be strengthened and interconnected through e-Health. They will be the focus of the overall transformation of health service delivery across the continuum of care. The benefits of e-Health will be realized through patient or citizen engagement with one or more of these eight components. Also shown in Figure 1 below are foundational elements that will help facilitate the efficient delivery of e-Health.
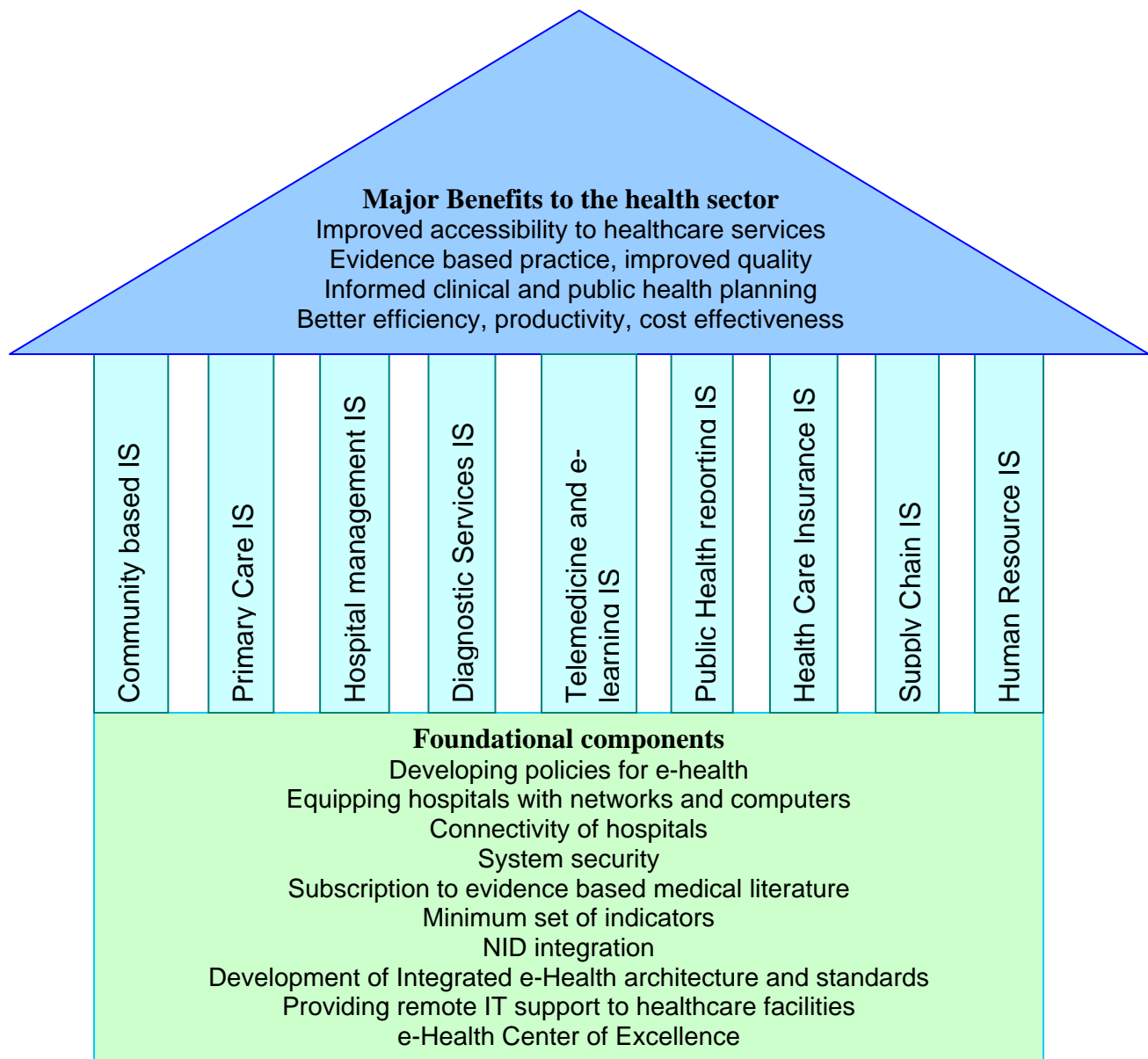
Figure 2. Key components of e-Health

The Nine e-Health pillar components and some foundational components are examined in detail in this section. A brief summary describing the basic nature of each component is provided. Each component is examined through: a general description of functions; an overview of the current state; the five-year vision or longer-term target state; the deliverables/benefits to be realized over the five years; and a list of the related e-Health projects that are planned or underway which will contribute to enhancing that particular component. (Some e-Health projects support or impact more than one component).

2.2.1 Community based Information Systems

Description/Scope

There are several healthcare interventions that are offered at a community level, mainly by Community Health Workers. This cadre of volunteer health workers is estimated to be around 30,000 in nearly every village in the country and is expected to double within the next few years.

Some of the activities that are carried out by the community workers include:

- Sensitizing the population on the benefits of health mutuelle membership, family planning, hygiene, prevention of HIV/AIDS and malaria;
- Supplying bed-nets, contraceptives and ORS/zinc to prevent dehydration in children with diarrhea;
- Distributing anti-malarials, antipyretics, and other medicines to treat respiratory infections and diarrhea;
- Sensitizing pregnant women to attend ante-natal consultations (ANC), to deliver in health facilities and to have their children vaccinated;
- Track and report on vital events in the village, in particular births and maternal and child deaths

One of the key functions of community health workers is to collect and report data related to maternal child health and surveillance indicators.

There is an urgent need to develop a Community Health Information System to support the national community health worker program.

Current State

The community health workers currently use paper based systems to carry their duties. This is not only inefficient but is also time consuming and affects the quality

Target State (in 5 years)

- Immediate reports to communicate information about particular events, such as cases of notifiable diseases that require immediate action, or take place on an ad hoc basis, such as training courses.
- Periodic Reports (Monthly, Quarterly, Semi-Annual, Annual) to transmit data between levels.

- Results of periodic surveys (eg. Household Survey, National Health Survey), record reviews and evaluations conducted by MOHE staff and its partners
- Qualitative information collected from communities, health workers and programme staff both through formal and informal channels.

Deliverables/Benefits

The community based information system will have the following benefits:

- Provide data for individual case management (patient or client forms, records and registers)
- Help community health workers better manage their services
- Ensure an adequate supply of essential drugs and supplies required by ASCs.
- Help health workers in their efforts to organize and monitor development work in their communities
- Provide data to FOSA level supervisors for supervision and other supportive action
- Provide data to district, national program staff, and donors for planning, monitoring and evaluation

Related e-Health Projects

- Use of mobile phones to support community Health workers
- Integrated community Health reporting with the National HIS
- Development of a National Integrated e-Health Architecture and standards

2.2.2 Primary Care Information System

Description/Scope

Primary care is the foundation of Rwanda's healthcare system. For most Rwandans, it is the first and most frequent point of contact with the healthcare system. It may include, for example, consultation at health centers, care by a midwife or nurse practitioner, or a visit to a private clinic.

Primary care is the component where most new health problems are identified and addressed, and where patients and providers work together to prevent and/or manage

most diseases. In Rwanda, the most common place to receive primary care is at primary health centers.

Current State

In Rwanda, all healthcare facilities rely heavily on paper-based records. Currently, in primary care the ability to access and share health information is very limited. Almost all healthcare centers have no computers and no connection to each other or to the internet. Care providers often spend precious time looking for important patient information or repeating clinical activities such as lab testing and record keeping. Patients experience duplication in the tests that are performed and the questions they are asked, leading to a relatively poor patient management, from an information sharing perspective. Only nine out of 515 primary healthcare facilities have electronic medical records and none of them has a laboratory of pharmacy management system. The inability of providers to effectively share and access health information leads to difficulties in providing consistent and coordinated patient care.

Target State

Improved information management and technology can help primary health care to improve patient health outcomes and patient safety by equipping primary healthcare providers with better equipments, tools and information for clinical decision support, and by allowing a gradual transition to technology assisted practice.

Beginning with 2010 in at least 100 primary healthcare facilities per year, patient health information is expected to be maintained in a standardized, shareable, electronic form. This will include medication histories, laboratory test results, immunization records, and other relevant patient information. The full patient record or a suitable subset will be easily transmitted to authorized care providers in other locations, and the results of specialist consultations will be electronically transmitted back to the primary care physician or nurse.

Management of patients with chronic diseases will be supported by comprehensive electronic records. Providers and patients will be prompted by system messages and flags to initiate regular tests and planned visits, based on clinical best practices and evidence-based guidelines.

Healthcare providers will schedule diagnostic tests and receive results electronically. Abnormal results will be automatically flagged for attention. Pharmaceuticals will be prescribed electronically and recorded in the patient's electronic record. Prescriptions from other sources, such as medical clinics or emergency departments, will be automatically added to the patient's record, with any possible drug interactions and allergies flagged immediately.

Deliverables/Benefits

- The integration of Electronic Medical Records, and chronic disease management functionalities will enable automated information sharing and facilitate improved patient outcomes.

- Laboratory results will be handled by systems that contain embedded "intelligence" to flag duplicate orders. Lab test ordering and results distribution will be automated.

- Access to reliable, relevant patient information will support processes associated with patient referral, on-call and emergency intervention.

- The clinical team will have immediate access to current and complete patient health information, with less duplication in data collection and data entry.

- Electronic discharge summaries will be available.

- There will be better coordination and consistency in patient care, especially when care involves multiple providers.

- Patients will no longer be subjected to unnecessary/duplicated tests and questions about their health condition.

Related e-Health Projects

- Development of a National Integrated e-Health Architecture and standards

- Development of a minimum package of Information system for Primary Health care that comprises; EMR, Laboratory reporting, Pharmacy management and integration with mituelle.

- Connectivity to primary healthcare facilities

2.2.3 Hospital Management Information Systems

Description/Scope

Acute care is a level of care in which a patient is treated for a brief but usually severe episode of illness, for conditions that are the result of serious disease or trauma, and during recovery from surgery. Acute care is generally provided in a hospital by a variety of clinical personnel using highly technical equipment, pharmaceuticals, and other medical supplies. In Rwanda acute care is provided in district hospitals and referral hospitals.

Most acute care hospitals across the Country include emergency services, surgical programs, medical treatment programs, laboratory services, diagnostic imaging and outpatient clinics. Each hospital may also have its own specialty programs, depending on the needs of the population it serves (e.g. maternity, pediatrics, psychiatry). Referral hospitals offer more specialized services such as tertiary trauma care, cardiology, neurology, oncology or thoracic surgery.

Current State

There are many different activities and functions carried out in the acute care hospital setting. The extent to which these activities are supported by electronic systems varies from hospital to hospital and from activity to activity. Only King Faisal Hospital and the Central University Hospital of Kigali have Hospital management information systems but these systems also do not support the majority of hospital functions. In the majority of hospitals mainly:

- Admitting records in larger hospitals are generally maintained manually.

- Key elements of the patient record in hospitals remain exclusively paper-based.

- In most cases, hospitals do not have coordinated systems for receiving electronic patient information from with in the hospital or for communicating patient information to care providers outside the hospital.

- Patient discharge summaries are transcribed onto paper.

- Diagnostic imaging results are not in a digital format, and are not accessible off-site.

- Laboratory test results are generally maintained on paper and are not available electronically.

- Information on hospital infectious disease control is limited.

- Patient prescription history is not available electronically.

Target State

All referral hospitals will have an integrated Hospital Management Information System that supports the following functions. District hospitals will have a selection of the functions depending on the size of the hospital and the services that are offered in that hospital.

1. Medical Record Number (MRN)
2. Registration and Booking
3. Pre-Admission
4. Admissions
5. Transfers and Discharges
6. Management Statistics / Reporting & Decision Making
7. Hospital Stores (Materials Management)
8. Scheduling / Appointments
9. Case Note Tracking
10. Electronic Medical Record
11. Laboratory
12. Radiology
13. Pharmacy
14. Security
15. Central Sterilizing Store Department
16. Dentistry
17. Nursing Services including CME (continuous medical education)
18. Infection Control
19. Surgery
20. Casualty / ER
21. Physiotherapy
22. Obstetrics
23. Anesthesiology and Intensive Care
24. Ophthalmology
25. Quality Control
26. Blood bank
27. Housekeeping and maintenance of wards
28. Built-in Kitchen and diet functions
29. Laundry Management
30. Library
31. Equipment Maintenance
32. Enterprise Management Services
33. Finance & Accounts

All key patient health records will be entered directly into interconnected electronic systems and will immediately be available to authorized clinicians.

Mechanisms will be established within the electronic systems to ensure information is positively identified as belonging to the individual patient, through a rigorous authentication process using the National Electronic Identity Card. Once a clinician has achieved positive identification of the patient, no repetitive gathering of personal information would be necessary. Patient data will be accessed by physicians across secure transmission networks, anywhere in the Country. Diagnostic images will automatically be available to clinicians, immediately after they are taken. Emergency departments will have similar access to patient records at the time of presentation.

A patient priority assessment system will be put in place for all major types of surgery, so that a comprehensive, consistent surgical wait list is created for the Country as a whole, and for each of the hospitals. The surgical wait list will cover the entire Country, containing reliable information, and will be kept current. Processes will be put in place to ensure that: only patients requiring surgery are on the list; patients are removed from the list when surgery has been completed or is no longer required; and the wait list is available to clinicians, their patients and the public at an appropriate level of detail.

Infectious disease control will be enhanced by the availability of real-time data on outbreaks, and hospitals will be able to move more decisively to better control the local spread of communicable diseases.

None clinical hospital management functions such as human resource management, Finance management, stock management, procurement, billing and credit control, asset management, etc. will be automated to improve the general performance of the hospital.

Deliverables/Benefits

- There will be a common method and a single point of access for e-Health information across the system.

- There will be an increased ability to integrate, identify and locate patient health information, regardless of where the information is collected and maintained.

- Standard assessment tools will be implemented for those awaiting surgery or other procedures. This will enable a more accurate wait list registry.

- None clinical hospital management functions such as human resource management, Finance management, stock management, procurement, billing and credit control, asset management, etc. will be automated to improve the general performance of the hospital.

Related e-Health Projects

- Hospital Management Information Systems for Referral and District Hospitals.

- National Lab Information System

- Integration of Electronic Health record with National Electronic Identity Card

- Development of a National Integrated e-Health Architecture and standards

2.2.4 Diagnostic Services Information Systems

2.2.5.1 Laboratory

Description/Scope

Laboratory services can be enhanced by using appropriate information systems that support these services. The automation of laboratory helps in reducing unnecessary repetition of such diagnostic tests and facilitates sharing of results.

Current State

Lab services are not supported by modern information systems. As a result, the availability of a patient's laboratory results at the point-of-care is not consistent across the country.

There is no ability for a clinician to access a patient's lab test history electronically or determine whether a patient's lab test has already been ordered by another physician. This can lead to potential duplication of testing, as well as delayed patient diagnosis and treatment.

Only three hospitals (King Faisal Hospital,

Target State

The goal, working in partnership with public and private labs, is to install a high-quality, patient-centered, accountable, affordable and sustainable laboratory system. It is anticipated that clinicians will be provided access to patient laboratory information at the

point-of-care anywhere in Rwanda. Health authorities will have timely access to reportable test results from all public and private laboratories.

Deliverables/Benefits

- Immediate physician access to laboratory results, enabling more timely and effective clinical decision making.

- Clinician access to historical laboratory test results across the Country, reducing needless duplication.

- Improved efficiency of laboratory test ordering and results distributions.

- Integration of private and public laboratories into the National Laboratory Information Solution.

- Enhanced continuity and consistency of care between care providers, in terms of sharing lab results.

Related e-Health Project

- National Reference Laboratory Information System

- Hospital Management Systems with capability for laboratory management

- Minimum package information system for primary health to include laboratory reporting

2.2.5.2 Diagnostic Imaging

Description/Scope

Diagnostic images and their interpretation are of high clinical value. However, their availability is constrained by the high capital and operating cost associated with imaging modalities and by the scarcity of the highly skilled health professionals who support diagnostic imaging services. It is therefore essential that Rwanda makes the best use of what information technology can afford by extracting the most clinical value possible from its imaging services.

There are several ways of acquiring digital images for easy interpretation, sharing and storage. These include, scanning x-ray films, using Computed Radiography or using digital radiology. In our setting Computed Radiography is the best option since it enhances the existing x-ray systems and does not require replacing the x-ray machines. It

also eliminates the need to use costly x-ray machines chemical products for development of the x-ray films.

Some of the key benefits of installing computed radiography machines are:
1. Relatively cheap to install with minimal running costs
2. A 'filmless' environment saves money by using re-usable Phosphorus plates and eliminates the need to purchase x-ray films development products
3. No film processing: The film processing in the dark room is eliminated
4. Faster process: The digital image is readily available.
5. The image parameters can be manipulated for better viewing and interpretation
6. The digital image size is relatively small which facilitates sharing over internet and storage on servers or other electronic media
7. Environmental friendly by avoiding the use of chemicals for processing
8. Dark rooms are not conducive for those who work there as they subject the worker to dark conditions for a lengthy period which is hazardous to the eyes. The CR system eliminates this.
9. The digital images are ideal for teleradiology

Current state:

All hospitals in Rwanda use the traditional X-ray units that use films. None of the hospitals has a Picture Achieving and Communication System (PACS). All X-ray interpretations are done at the hospitals where they are filmed. Apart from referral hospitals which have a radiologist to interpret the X-rays, the rest of the X-ray interpretations are done by physicians who have limited knowledge in diagnostic imaging. This may result in improper diagnosis, poor management and wastage of resources.

Target State

The goal is to have all diagnostic images stored in a "filmless" digital form, and for them to be available to clinicians regardless of the care delivery or clinical practice setting. Access to and management of images will be part of an integrated capability that supports all aspects of diagnostic imaging service delivery, including workflow support (patient registration, scheduling, transcription, etc.). It will be integrated with the rest of the hospital's clinical services and overall information flow.

Deliverables/Benefits

- All hospitals equipped with Computed Radiography machines that generate instant digital images for easy interpretation, sharing and storage of digital images.

- There will no need to purchase x-ray films and x-ray film development chemicals and hence no need of having dark rooms

- The cost of acquiring an x-ray image will become cheaper

- Availability of digital x-ray images for sharing (teleradiology)

- All major hospital diagnostic imaging reports and some private clinic reports to be available electronically;

- Possibility of remote interpretation of diagnostic images;

- Improved ability for care providers to share patient information with each other.

- Improved access to patient diagnostic imaging results, leading to decreased duplication in testing.

Related e-Health Project

- "Filmless Hospital" project under the e-Rwanda telemedicine project

- Picture Archiving and Communication System (PACS) at referral hospitals

2.2.5 Telemedicine and e-Learning Information Systems

Description/Scope

Telemedicine is the use of communications and information technology to deliver health and healthcare services, information and education, where the participants are geographically separated. It helps to overcome barriers of geography, transportation infrastructure, time, and socio-economic disparity. Telemedicine facilitates clinical consultation including patient assessment, diagnosis and treatment, continuing professional education, health promotion, and healthcare management. Both broad and low bandwidth (telephone) infrastructure and technology are used in the provision of Telemedicine services. A major focus of Telemedicine is improving access to health

services in remote and rural parts of the Country, and improving healthcare service delivery.

Telemedicine is an encompassing term for various electronically enabled communications and information-transfer services. There are two types of telemedicine interventions; synchronous or real time telemedicine where the involved parties communicate in real time and asynchronous or "store and forward" telemedicine where, typically a patient's file is prepared and sent electronically to a specialist for second opinion and a response sent back after reviewing the file.

Current State

The success for telemedicine relies on availability of communication infrastructure. There is evident commitment from the top leadership to build a strong and reliable telecommunication infrastructure throughout the country but despite this commitment there is still a large "digital divide" between rural and urban areas. This digital divide is delineated by geography, income, education level, literacy, etc...

There are mainly three telemedicine projects that are currently underway:

i) The Inter-hospital Virtual Local Area Network: This is fiber-optic network that connects the three teaching hospitals with videoconferencing facilities. The network currently connects the three teaching hospitals; King Faisal Hospital, Kigali, Central University Hospital of Kigali and the Central University Hospital of Butare. The main activities that are carried out on the network are e-learning and administrative meetings.

ii) The e-Rwanda Telemedicine Project: This project aims to connect district hospitals to rural hospitals and will run both synchronous and asynchronous telemedicine. The project is underway and will connect two district hospitals (Kabgayi and Ruhengeri) in the second quarter of the year 2009. This project will also involve the use of computed radiography, which eliminates the use of x-ray films and provides instant digital images that are easy for interpretation, exchange and storage. The aim is to have all district hospitals connected to this network.

iii) The Pan-African e-Network Project: This project connects at lease one hospital in every African Union Member State to several super-specialized hospitals in India. The aim of the project is to enable telemedicine consultations between African and Indian hospitals. Currently installations are being done in Rwanda and the rest of Africa and telemedicine services under this project will commence in the second quarter of 2009. The aim is also to connect this network to the e-Rwanda Telemedicine network.

Target State
- National role out of e-Rwanda network with functional telemedicine platforms installed in all hospitals to provide store and forward and real time telemedicine
- Ability to exchange patient information with selected hospitals outside Rwanda for diagnosis and treatment. This should significantly reduce the number of patients that are transferred abroad for specialized services.
- E-Learning System that supports teaching in rural hospitals to support the upgrade of nurses from A2 to A1 level

Key Deliverables
- Ability to carry out telemedicine consultations between district and referral hospitals before the end 2010.

- Reduction of the number of patients that are transferred from district to referral hospitals by 50% before the end of 2010

- Reduction of the number of patients that are transferred outside Rwanda for specialized services by 30% before the end of 2010.

- All healthcare providers in district and referral hospitals trained in the use of telemedicine technologies.

- At least 50 A2 nurses being enrolled in the e-learning program to upgrade to A1 level

Related e-Health Projects
- e-Rwanda Project

- Pan African e-Network Project.

- e-Learning project

2.2.6 Population and Public Health Information Systems

Public health is "the science and art of promoting health, preventing disease, prolonging life and improving quality of life through the organized efforts of society." Public health is largely synonymous with the population health approach. It includes health surveillance as an integral part of disease prevention and control, and uses its information products to evaluate, develop and guide health policy and programs. Public health requires the timely sharing of information among health authorities.

A public health approach is sensitive to the determinants of health — the factors or conditions that affect health status (e.g. income and social status, education and literacy, employment/working conditions, social and physical environments) — and includes processes and multiple strategies that:

- focus on the health of a population as a whole;

- address the determinants/indicators for health and their interactions;

- base decisions on evidence; and

- support collaboration across sectors and jurisdictional levels.

Current State

An old Health Information System is being phased out. It had not been designed to easily pass information/data from one program area to another or pass it from one system to another. This resulted in limited data entries, duplication, loss of critical information, higher costs, and missed opportunities for timely intervention and prevention.

A new National Health Information System that will provide answers to the above problems is being installed country wide. Project is well underway, which will enhance the country's ability to use timely information and enhance public health protection services.

TRACnet is a system that collects indicators provides reports on HIV/AIDS. The system has been successfully operational for several years. A diseases surveillance system is being developed in TRACnet and this will provide instant messages related to epidemics.

There are several other data collection tools in the country and these often collect similar sets of indicators. The collection and entry of indicators in multiple systems poses a great burden to healthcare workers especially at the primary healthcare level where most of the indicators are collected and entered.

Target State

Within one year, more reliable public health information will be available to the decision makers, care providers and the public, when and where they require it.

Public health workers will have an integrated system that operates in an easy-to-use, consistent manner. Data collection tools will be harmonized such that data entry for a particular indicator is collected and entered once but shared among other relevant tools.

Public health issues and communicable diseases will be quickly identified and managed to mitigate risk to the general public. A health surveillance system will provide information on risk factors, treatment, health service utilization and outcomes to assist in the development and evaluation of policies and programs aimed at the prevention and control of infectious and communicable diseases. Aggregated data will be easily accessed by the Ministry for reports on statistics and trends to support health planning and decision making.

Deliverables/Benefits

- Health planners will have access to timely and improved aggregated data to support evidence-based decisions.

- There will be an improved ability to collect standardized health information across the Nation in a timely fashion without duplication of data entry in the various data collection tools.

- There will be timely recognition of infectious disease outbreaks, which can facilitate prompt patient treatment and containment of the outbreak.

- There will be better public health reporting and risk assessment to improve the timeliness and effectiveness of interventions.

Related e-Health Projects

- The National Health Information System Project

- TRACnet

- Development of a National Integrated e-Health Architecture and standards

- Harmonization of indicators

2.2.7 Healthcare Insurance

Description/Scope

Health Insurance plays an important role in healthcare provision. It enhances financial accessibility to healthcare services. In Rwanda there are mainly two public healthcare insurance schemes; RAMA and Mutuelle de Santé. More than 80% of Rwandan citizens have health insurance coverage. The Government aims at providing healthcare insurance to all citizens by the end of the year 2009. There is a need to automate healthcare insurance services. This will facilitate citizens in receiving healthcare services from all parts of the country and will provide seamless healthcare claims and processing.

Current State

All healthcare insurance related services including authentication and claim processing are paper based.

Target Benefits

Information regarding citizens' health insurance affiliation can be retrieved in all parts of the country and citizens can receive healthcare services in any part of the country, a phenomenon that is often referred to as "Patient roaming".

Having a unique identifier for every citizen for authentication (Integration with NID) that serves for the different insurance schemes.

Seamless claims processing throughout the country for all healthcare insurance schemes.

Related e-Health Projects

- Integration with NID for authentication
- Development of back-end databases for RAMA and Mutuelles

2.2.8 Supply Chain Information Systems

Description/Scope

Procurement, supply and tracking of drugs and consumables are critical functions of the healthcare system. Automation of these processes leads to improved stock management, reduces drug expiry and reduces the cost of delivering to the consumers among may other benefits.

There is need for a networked linkage between pharmacies in all health facilities into a central system. Coupled with pharmacy management systems at hospitals and health centers the systems will provide data and services to support drug distribution, dispensing drug monitoring and claims processing.

Key benefits of drug procurement and tracking system and healthcare facility pharmacy management systems are:

- Proper distribution of drugs to where the need for a particular drug is;

- Expiry dates and stock situation alerts for better inventory management;

- Prevention of inappropriate therapies by enabling drug interaction and dosage range checking;

- Prevention of over consumption of prescription drugs by unintended duplication or fraud;

- Promotion of cost effective usage of drugs and other therapeutic alternatives;

- Improvement in standards of practice by offering comprehensive drug information and complete patient medication information.

Current State

The National drug procurement and distribution agency is in the process of computerizing its warehouses. A drug supply and tracking system that manages all information related to drugs and consumables up to the district level is planned.

All public and private pharmacies don't use modern information systems and there is no integration at any level.

Target State

- Having a National drug procurement and tracking information system that manages National drug procurement supplies

- Equip all healthcare facilities with pharmacy management systems that are integrated with the National drug procurement and supply system.

Deliverables/Benefits

- Ability to monitor drug expiry dates and stock situation alerts for better inventory management at National, district and facility levels.

- Patient medication histories more complete by including drugs dispensed in a wider range of settings (such as hospitals, clinics, and health centers).

- Physicians able to make better clinical decisions by knowing the patient's complete medication and related treatment history.

Related e-Health Projects

- National drug procurement and tracking system

- Hospital Management Systems with capability for pharmacy management

- Minimum package information system for primary health to include pharmacy management

2.2.9 Human Resource Management System

Description/Scope

Human resource management is key to an improved healthcare system. There is a need for decision makers to know the available human resource in the country, their different levels of training, distribution, production from teaching institutions and the required training, etc.

Current State

A human resource management system has been installed and the necessary data entries are being entered. There is a need however, for the system to be deployed to all healthcare institutions Nationwide for regular update and usage.

Target State

To have a human resource Management system that informs policy makers of the state of human resource in terms of availability, distribution, training levels, rate of production from teaching institutions, employee motivation, payroll management, benefits management, taxation, etc. The system will also be used by managers of Healthcare facilities to get informed of their human resource needs.

Related e-Health Projects

- Human Resource Management Information System

The following sets of e-Health service elements are foundational elements whose functions cut across and support other e-health activities.

2.2.10 Integrated e-Health Architecture and standards

Description/Scope

Integrated e-Health architecture is the foundation for achieving success in our e-Health vision. Much of our healthcare policy and practice requires clinical information sharing that is only possible if there are high levels of interoperability between systems. There is a need to exchange information among Electronic Medical Records, reporting tools, drug management tools etc… hence the need for interoperable systems. Interoperability means "the ability of information and communication technology (ICT) systems and of the business processes they support to exchange data and to enable the sharing of information and knowledge". For systems to be interoperable there has to be a defined architecture that describes the way in which systems "talk to each other" and standards for the data that is supposed to be exchanged.

Current State

Currently there is no defined e-Health architecture and there are no defined data standards. This renders all existing databases to be "silos". However it has been strongly recommended that all systems should be compliant with international standards such as HL7, DICOM, SINOMED, etc so that once the interoperability architecture is completed, integration will not require significant re-engineering of existing systems

Targeted Benefits

- Creation of a Blue Print document that clearly defines the e-Health architecture and standards that are agreed upon. This document will guide the development of new e-Health applications and the customization of existing systems to suite the integrated architecture.

- Integrated Electronic Medical Records such that healthcare workers can access individual healthcare records from all parts of the country.

- Hospital management systems and EMRs being able to synchronize and send data into reporting tools.

- Seamless data exchange among systems with minimal duplication of data entries.

Related project

Development of a National Integrated e-Health Architecture and standards

2.2.11 Unique Identifier/Integration with NID

Description/Scope

The Government of Rwanda is in the process of issuing new Identity Cards. The new cards are electronic and carry some information that comprise a unique number for every citizen. There is a great need to use that opportunity and to use the unique numbers as unique identifiers for medical records and health insurance. This will great facilitate our e-Health integration efforts that will provide patient centered services.

Current State

Only citizens that are 16 years and above are eligible for obtaining electronic IDs. The cards that are currently in place can store very limited information that is stored in a barcode. There are no health-related systems that are integrated with these electronic cards.

Phase II of the National ID project will involve release of smart cards that can store a lot of information. It is envisaged that there smart cards will store a minimum set of information including key health information for all card holders. The unique numbers in the cards will also be used for healthcare insurance authentication.

Targeted Benefits

Unique Health Identifiers for all citizens

Health Insurance authentication using electronic ID

Access to health records through out the country using the unique ID number

Related e-Health Projects

- Hospital Management Information Systems for Referral and District Hospitals.

- Interoperable Electronic Health Record

- Integration of Electronic Health record with National Electronic Identity Card

- Electronic Medical Record (EMR) Standards

2.2.12 Other foundational e-Health components

This part outlines the other foundational components that are key to the success of e-Health. The related projects for these components are outlined in Part Three of this document.

- Developing policies for e-health
- Equipping hospitals with networks and computers
- Connectivity of hospitals
- Systems security
- Providing remote IT support to healthcare facilities
- Subscription to evidence based medical literature

2.3 Summary of the Benefits of e-Health

In five years, Rwanda will have made significant progress towards implementing e-Health and supporting the transformation of care delivery across the entire spectrum of health services. The general public, patients, healthcare providers and the health system will experience benefits through the integration of information, technology and services.

With the adoption of e-Health, Rwanda will be a country where:

Care providers have the correct and necessary information required to make appropriate and timely clinical decisions concerning patient care. For example:

- A primary care physician in northern Rwanda is concerned about the worsening symptoms one of his patients is experiencing. Through the use of Telemedicine technology, the physician is able to immediately initiate a consultation with the appropriate specialist, who is located some distance away at a tertiary hospital. The physician receives timely expert advice to guide clinical care for this patient, and the patient does not have to endure long distance travel to obtain proper care.

- A patient is brought by ambulance to a local emergency department in critical condition. The patient is unconscious and unable to provide details about her past medical history. The emergency physician has secure and immediate electronic access at the point-of-care to this patient's previous drug information, laboratory results, and diagnostic images, which assists the physician in quickly diagnosing the clinical condition and providing effective, timely treatment.

- While prescribing in a hospital, a doctor is able to tell the adverse effects of a drug, its drug-drug interactions, drug-disease interactions, availability in the pharmacy, etc.

Patients have access to safer, higher-quality services enabled through the timely availability of their health information. For example:

- A patient is sent to see a specialist about a worsening medical condition. The specialist can electronically access pertinent clinical information such as the

patient's hospital records, as well as previous lab and diagnostic imaging results. This patient will not have to experience unnecessary duplication in the provision of personal health information or diagnostic testing.

Healthcare facility managers can manage hospitals with great efficiency. For example:

- A Hospital director is informed of his departmental daily income and expenditures and can practice cost center management. He can tell the daily pharmacy stock, the expiry dates and alerts for initiating procurement processes. He can also get all necessary reports including clinical and none clinical reports.

Epidemiologists are informed of an epidemic as it unfolds:

- For example, community health workers are able to report epidemics using mobile phones, a National disaster management team is informed in a timely manner and responds appropriately. All maternal and child deaths are reported by community health workers and aggregated reports sent in a timely manner to the concerned health authorities.

Drugs and other commodities management is done appropriately with less stock-outs and less expiry of drugs. For example,

- The head of central drug procurement agent can tell that in district A they are running out of stock of particular drugs and in district B that particular drug is about to reach its expiry date. He is able to redistribute the drug to avoid stock-out and the wastage.

The health system as a whole has improved access to more comprehensive information that enables better informed public health protection and overall health service planning, which results in increased efficiencies. For example:

- Improved quality of data that is provided by the Health Information System (SIS) assists the Ministry and health authorities to make more informed decisions concerning the overall operation of the health system. Most health service planning decisions depend on access to aggregated health information, such as the number of hospital admissions related to specific conditions or the incidence of reportable diseases in a specific geographic area. Through the

review and analysis of this data, decisions can be made regarding the overall need for new or expanded health programs.

This section of the framework has provided an overview as well as some specific examples of the key components of the health system that will be enhanced through e-Health. It also highlighted the specific benefits that will be experienced by the general public, patients, care providers and the overall health system.

The next section (Part Three) describes in detail the implementation strategy, and the individual projects designed to realize the tangible benefits of e-Health over the next five years.

Part Three: Implementation Strategy

The long-term vision for e-Health in Rwanda is to have "an integrated, interoperable e-Health system in which healthcare information is accessible, when and where it is needed to support personal health, healthcare decision making and health system sustainability."

Achieving the vision and benefits of e-Health is an exciting journey that will enable significant movement towards the positive transformation of health care in Rwanda. To achieve the long-term vision for e-Health, an implementation strategy has been developed which outlines the key actions that need to be taken and the corresponding milestones that need to be met.

3.1 Phased Implementation

The implementation strategy has three interconnected phases, each phase representing a specific stage in the progressive implementation of e-Health.

The first phase involves building the infrastructure and enabling access to priority clinical information, the second phase results in enhanced clinical capability through knowledge-based tools, and the third phase provides the capability of integrating systems to support coordinated care across the country. There are, however, some activities that have been identified as priorities and have been brought forward from the phases where they would otherwise belong.

Phase 1: Access to priority clinical information

The focus of Phase One is to build foundational infrastructure and to provide clinicians with key clinical information at the point-of-care and provide citizens and patients with credible sources to access health information. The strategic intent of this first phase is to invest in e-Health projects that enable health information to be accessible regardless of geography.

The foundational projects of Phase One are important building blocks required to support the implementation of the clinical projects.

Phase 2: Enhance capability through knowledge-based tools

The second phase builds on the infrastructure from Phase 1 and begins to add some of the higher level of functionality of e-Health. This phase will expand the number of accessible data sources to include areas such as community care, public health, and expand the level of integration for clinical information within individual settings. Phase Two will move e-Health beyond just providing access to clinical data, it will begin to integrate clinical systems and introduce additional functionality into the existing applications.

Phase 3: Integrating systems to support coordinated care across the continuum

The third phase builds on the capabilities developed in previous phases to enhance coordination of patient care across the continuum.

Phase Three focuses on implementing e-Health components that enable information sharing between health authorities and creating seamless information transfer between care providers across the country. The result will be an integrated, interoperable e-Health system which contains patient health information that spans the entire continuum of care across many settings and locations. This information can be securely and appropriately accessed by hospital and community healthcare providers anywhere in the country.

Each phase builds on the previous phase, with no one phase being entirely independent or discrete. For example, the functionality gained in Phase One, through improved access to priority clinical information, will enhance the functionality of Phase Two and Three projects. A phased approach to implementing e-Health allows a focus on accomplishing specific deliverables and benefits at each phase, and creates incremental successes from which to build and attain the full vision for e-Health.

3.2 Project Management

As stated in Part One of this document, the overall governance of e-Health development and implementation resides with the proposed e-Health Department. Recognizing that no e-Health project stands entirely alone or independent of the others, all projects will be managed and coordinated so as to ensure their full alignment with the e-Health strategic framework. This fundamental alignment will be ensured by the e-Health Department

through its high-level review and ongoing leadership for all e-Health initiatives undertaken by the country.

The individual e-Health projects included in this strategic framework will generally be managed by the e-Health Department under the leadership of the Ministry of Health.

Depending on the nature of the project, it may:

- involve the Ministry, one or more health authorities and other stakeholders, such as physicians, etc…

- be led by either one health authority or by the Ministry, and then implemented by all health authorities.

Each project will identify a lead sponsor and a project steering committee that typically includes both clinical and technical representatives. A project charter is a primary document used to guide project teams in planning their work. A charter will be developed for each project, defining the project in terms of its objectives, scope, stakeholders and major deliverables, along with other required standard elements. In its governance role, the e-Health Department will determine whether projects (as indicated by their charters) are consistent with the overall strategic framework and National priorities. The charters also serve as a reference point for the e-Health Department in its ongoing monitoring role to ensure achievement of the promised project deliverables and continued alignment with the National e-Health vision.

3.3 Financial Resources

E-Health is a priority across Rwanda, with significant contributions being made at the National level.

The Rockefeller Foundation, Gates Foundation, the World Bank and the International Telecommunication Union are the other major potential sources of strategic funding that are targeted. These organizations have the willingness to finance Information Systems and some of them have expressed their interest in funding e-Health. Full funding for projects will be dependent on the successful attainment of interim performance targets. As a result, investment forecasts at the project level are in part Notional.

An estimated budget for each project has been calculated basing on the activities that are involved for each project. **Annexure C** is a summarized table that demonstrates the different projects with their corresponding budgets.

3.4 e-Health Project Descriptions

This section describes the e-Health projects that have been prioritized for implementation over the next five years. Many of the projects will be planned and implemented concurrently; however, there are also some projects that need to be implemented sequentially. The timeliness outlined for some of the projects are estimates that will be confirmed as more detailed planning occurs over the upcoming months. Some projects may be completed faster than their estimated timelines, while others may be slower. Project timelines are also contingent on other factors, which may be beyond the control of project leads, such as the development of the National ICT infrastructure, timing of formal approvals, new legislative issues, or the availability of critical specialized resources.

Some of the projects that are targeted to be implemented within the next five years include:

The following portion of Part Three provides a series of summarized tables covering each of the planned projects, outlining the project goal, project title, description, responsible person. Key stakeholders, problem statements, benefits, key expected activities and estimated timelines. The table ends by briefly highlighting the corresponding estimated cost for each activity in the different projects. **Annexure B** contains the identified projects in the next five years.

3.5 Ensuring Successful Implementation

The implementation of e-Health in Rwanda is about fundamental cultural and business process changes in the way healthcare is delivered across the country. It is about enabling the transformation and modernization of service delivery methods to improve the quality, timeliness, safety and efficiency of healthcare service delivery. A high level of coordination and integration is critical to the successful implementation of the e-Health strategy. In particular, the key factors that are required to achieve success include:

- Strong and enduring National leadership - ensuring the realization of the e-Health vision;

- Unwavering commitment - ensuring successful completion and uptake of the e-Health projects;

- Collaboration - key stakeholders working together throughout the implementation of the e-Health strategy;

- Physician engagement - ensuring that physicians are actively engaged and participating in the e-Health projects, as well as the development of a strategy that continues to ensure that physicians remain "on board" over time;

- Connectivity to health information - ensuring care providers have the secure, physical connectivity required to access the National e-Health systems and evidence-based literature.

The e-Health Department will provide the strong leadership and commitment required to guide the implementation of e-Health in Rwanda. The Department will also take an active role in facilitating collaboration among key stakeholders across the Country.

Connectivity and integration have been identified as essential components of an effective e-Health system and are imbedded in the foundational aspects of e-Health development.

Throughout the planning and development of the e-Health strategy and the individual e-Health projects, there has been significant attention directed towards each of the success factors. Rwanda is well positioned to successfully implement the e-Health initiatives and achieve significant health care benefits.

3.6 E-Health Governance

Scope and functions

There is a great need for a streamlined e-Health Governance if the vision for e-health is to be attained. A proposal for an e-Health structure has been made and **Annexure A** is a diagrammatical representation of the organic structure. It is proposed that an e-Health Department in the Ministry of Health be created. The department will be responsible for e-Health related initiatives aimed at the creation, adoption or enhancement of significant information systems (whether infrastructure, applications, standards or data). For this set of initiatives, the function of this Department will be to:

- Resolve issues related to strategy, priorities, governance structure and implementation approaches;

- Provide central strategic planning, initiative endorsement and approval;

- Provide effective integration and harmonization between initiatives;

- Rationalize the accountability and reporting processes of the various project working groups to ensure a fully coordinated approach;

- Review recommendations from advisory and project working groups;

- Ensure effective communications with executive stakeholders;

- Present recommended courses of action to the Ministry of Health for approval, where necessary; and

- Create working groups for particular projects.
- Developing the overall business architecture for the e-Health system;
- Engage with stakeholders across the country to gain their participation in building awareness of the e-Health strategy and activities;
- Leverage available financial resources and sourcing for extra funding;
- Develop detailed implementation plans for e-Health strategies;
- Design the architecture for an integrated e-Health system and setting standards for e-Health systems;

- Safeguard privacy and security for health information;

- Set strategies and evaluation measures for the e-Health Department;

- Make a governance and accountability model that will allow e-Health to be managed in a way that delivers on the government's goals of transforming the healthcare system in a coordinated and integrated way;

- Conduct external reviews of e-Health initiatives to ensure that they are following best practices when it comes to project governance, charters, and other critical elements;

- Identify other policy or regulatory recommendations to ensure that no unintended hurdles remain that might get in the way of e-Health initiative implementation.

The Department, through its designated members, will interact with other key stakeholders such as all member institutions of the Rwanda Biomedical Center to discuss on the proposed and new initiatives and the implementation approach.

Reporting and accountability

The Department through its head will report to the CEO of the Rwanda Biomedical Center regarding all technical matters and to the Permanent Secretary of the Ministry of Health regarding strategic orientations.

The Department will submit quarterly reports of progress made to the CEO of the Rwanda Biomedical Center. Regular executive summaries of the reports will be transmitted to the Minister of Health via the Permanent Secretary of the Ministry of Health.

Communications

The Department will have responsibility to provide education and leadership in e-Health initiatives to participants and executive stakeholders. It is required to communicate the National e-Health vision and the progress towards its implementation via different mechanisms such as the Ministry of health Website and other official mechanisms.

3.7 Summary

The time is right to fully commit and move forward with the National e-Health strategy. The leadership is aligned and committed, the funding will be obtained and the benefits to the overall health system in Rwanda are clear. Implementation is now of paramount importance.

The implementation of e-Health enables significant progress towards improved continuity and coordination of health services, early detection of disease and illness, and better information on healthcare needs and outcomes.

Progress in these fundamental areas will move Rwanda closer towards having a health system that is sustainable, affordable, publicly funded and delivers excellent quality health services to its citizens.

Over the next five years, key clinical and foundational projects will be implemented. The implementation of these e-Health projects will enhance current care processes and, more importantly, will transform clinical and business practices enabling improved quality of health and healthcare.