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Improving Health, Connecting People: The Role of ICTs in the Health Sector of Developing Countries

A Framework Paper

31 May 2006

Improving the health of individuals and communities, and strengthening health systems, disease detection and prevention are crucial to development and poverty reduction. ICTs have the potential to impact almost every aspect of the health sector. In public health, information management and communication processes are pivotal, and are facilitated or limited by available ICTs.

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Improving Health, Connecting People: The Role of ICTs in the Health Sector of Developing Countries

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Executive Summary

This paper provides a snapshot of the types of information and communication technology (ICT) interventions being used in the health sector, and the policy debates involving ICTs and health. The paper draws from the experiences of both the North and South, but with a focus on applicability in the South to identify the most effective and relevant uses of ICTs. It is aimed at policymakers, international donors, local practitioners, and others who are involved in the development or management of programs in the health sector in developing countries.

The paper describes the major constraints and challenges faced in using ICTs effectively in the health sector of developing countries. It draws out good practices for using ICTs in the health sector, identifies major players and stakeholders, and highlights priority needs and issues of relevance to policymakers. The paper also looks at emerging trends in technologies that are likely to shape ICT use in the health sector, and identifies gaps in knowledge.

For the purposes of this paper, ICTs are defined as tools that facilitate communication and the processing and transmission of information by electronic means. This definition encompasses the full range of ICTs, from radio and television to telephones (fixed and mobile), computers, and the Internet.

This paper sees health as a complex interaction of biomedical, social, economic, and political determinants. It places the discussion of health firmly in the context of poverty and development debates. It pays particular attention to how ICTs can best be used to help achieve the Millennium Development Goals (MDGs), as part of poverty reduction strategies and in order to improve the health of the most poor and vulnerable people.

There has been considerable international discussion about the potential of ICTs to make major impacts in improving the health and well being of poor and marginalized populations, combating poverty, and encouraging sustainable development and governance. Used effectively ICTs have enormous potential as tools to increase information flows and the dissemination of evidence-based knowledge, and to empower citizens. However, despite all their potential, ICTs have not been widely used as tools to advance equitable health care access.

A critical mass of professional and community users of ICTs in health has not yet been reached in developing countries. Many of the approaches being used are still at a relatively new stage of implementation, with insufficient studies to establish their relevance, applicability or cost effectiveness (Martinez, et al, 2001). This makes it difficult for governments of developing countries to determine their investment priorities (Chandrasekhar and Ghosh, 2001). However, there are a number of pilot projects that have demonstrated improvements, such as a 50 percent reduction in mortality or 25-50 percent increases in productivity within the healthcare system (Greenberg, 2005).

The examples in this paper show that ICTs have clearly made an impact on health care. They have:

- **improved dissemination** of public health information and facilitated public discourse and dialogue around major public health threats;
- **enabled remote consultation**, diagnosis and treatment through telemedicine;
- **facilitated collaboration and cooperation** among health workers, including sharing of learning and training approaches;
- **supported more effective health research** and the dissemination and access to research findings;

- **strengthened the ability to monitor** the incidence of public health threats and respond in a more timely and effective manner; and
- **improved the efficiency** of administrative systems in health care facilities.

This translates into savings in lives and resources, and direct improvements in people's health. In Peru, Egypt and Uganda, effective use of ICTs has prevented avoidable maternal deaths. In South Africa, the use of mobile phones has enabled tuberculosis patients to receive timely reminders to take their medication. In Cambodia, Rwanda, South Africa, and Nicaragua, multimedia communication programs are increasing awareness of how community responses to HIV and AIDS can be strengthened. In Bangladesh and India, global satellite technology is helping to track outbreaks of epidemics and ensure that effective prevention and treatment methods can reach people in time.

Experience demonstrates that there is no single solution that will work in all settings. The complexity of choices of technologies, as well as the needs and demands of health systems suggests that the best way forward is to gradually introduce, test, and refine new technologies **in those areas of health care where there is a reasonable expectation that ICTs can be effectively and efficiently used.**

Some innovative leaps may also be possible as technology is evolving rapidly. Some of the trends identified in this paper that suggest new opportunities include wireless applications, increased use of mobile telephony, and combinations of technology working together.

The paper concludes that opportunities do exist for the use of ICTs in the health sector of developing countries. However, a number of issues must be carefully considered in each intervention and setting:

- To what degree are the health sector structure and the national regulatory framework conducive to problem-oriented, interdisciplinary, rapid-response collaborative technical work and to implementing the political, regulatory, and managerial tasks required to address multifaceted and complex technological problems?
- Have the goals, action plans and potential outcomes and benefits been clearly defined?
- Are there mechanisms for coordinating action led by the public sector in a way that links public, private, and social efforts, and engages with diverse stakeholders to speed the development and use of priority ICT solutions?
- What progress has been made in telecommunication sector reform and expansion of affordable ICT access?
- Are data-related standards and a regulatory and legal framework in place?
- Are there mechanisms for developing the capacity of health workers, other intermediaries and community members to make the most effective use of the ICTs available and to develop content that is relevant, applicable, and culturally appropriate?
- What options exist to ensure continuity and sustainability of ICT projects and programs in terms of finance flows, public-private partnerships and building on existing information and communication channels and resources?

Seven broad conclusions can be drawn about the use of ICTs in the health sector. These conclusions should be applicable at all levels. Although they are expressed simply here, the complexity of putting them into practice is one of the biggest challenges in ensuring that the benefits are spread to the health system, health care workers, and the people who make use of the health system – the patients and citizens. The seven conclusions are:

1. Keep the technology simple, relevant, and local.
2. Build on what is there (and being used).
3. Involve users in the design (by demonstrating benefit).
4. Strengthen capacity to use, work with, and develop effective ICTs.

5. Introduce greater monitoring and evaluation, particularly participatory approaches.
6. Include communication strategies in the design of ICT projects.
7. Continue to research and share learning about what works, and what fails.

The paper also highlights several major areas where not enough is known and where further experimentation, research, and analysis are needed, including:

- moving from proof-of-concept to large-scale implementation in a range of different settings;
- evaluating the impact of the use of ICTs on health in a systematic and coherent way;
- sharing information and experience and coordinating efforts (at national, regional and international levels) around the use of ICTs in the health sector;
- strengthening the role of and building the capacity of intermediaries;
- developing local content that is relevant, appropriate, and practical;
- strengthening organizational and national human resources, awareness, skills, and leadership to champion the further development of ICT use in the health sector;
- enabling the voices of those most affected by poor health to be heard, and
- implementing a range of standards and a regulatory and legal framework that is conducive to the development of a vibrant ICT sector that responds to and supports social development processes.

These questions help to set out an agenda for future action to enable ICTs to contribute to efforts to improve health, and to achieve health-related MDGs.

Section 1 outlines the aims, audience, and scope of this paper.

Section 2 provides a broad introduction to information and communication technologies; highlights the way in which they can be used to help meet the health-related MDGs; explores the need to build on evidence; and identifies the many beneficiaries, intermediaries, and other stakeholders who are involved in the effective use of ICTs in the health sector.

Section 3 explores potential and actual use of ICTs in the health sector. It examines the ways in which ICTs can help to strengthen four main pillars of any health system – information, management of health services, human resources, and financing.

Section 4 highlights eight major constraints and challenges that need to be faced in integrating the use of ICTs into the work of the health sector.

Section 5 identifies emerging technological trends that may shape future use of ICTs in the health sector, particularly exploring those uses that help to extend the reach of the health system to rural and difficult-to-reach settings. Approaches that may help increase the involvement of patients and citizens who are most vulnerable to the impact of ill health are also examined.

Section 6 draws out key lessons.

Section 7 identifies the major areas where further exploration is needed to build a stronger evidence base of how to use ICTs effectively in the health sector in developing countries.

Section 8 gives the references used in this paper. An annotated bibliography and knowledge map that this paper draws upon is available at: www.asksource.info/res_library/ict.htm.

Contents

1. Introduction

In developing countries, preventable diseases and premature deaths still inflict a high toll. Inequity of access to basic health services affects distinct regions, communities, and social groups. Under-financing of the health sector in most countries has led to quantitative and qualitative deficiencies in service delivery and to growing gaps in facility and equipment upkeep. Inefficient allocation of scarce resources and lack of coordination among key stakeholders have made duplication of efforts, overlapping responsibilities, and resource wastage common and troublesome problems.

Most countries are at some stage of health sector reform, trying to provide expanded and equitable access to quality services while reducing or at least controlling the rising cost of healthcare. Health reform processes have many facets and there is no single model being adopted by all countries (PAHO, 1998). ICTs have the potential to make a major contribution to improving access and quality of services while containing costs. Improving health involves improving public health and medical programs designed to provide elective, emergency, and long-term clinical care; educating people; improving nutrition and hygiene; and providing more sanitary living conditions. These in turn ultimately involve massive social and economic changes, as many health challenges go well beyond the health sector.

The health sector has always relied on technologies. According to WHO (2004), they form the backbone of the services to prevent, diagnose, and treat illness and disease. ICTs are only one category of the vast array of technologies that may be of use. Given the right policies, organization, resources, and institutions, ICTs can be powerful tools in the hands of those working to improve health (Daly, 2003).

Advances in information and computer technology in the last quarter of the 20th century have led to the ability to more accurately profile individual health risks (Watson, 2003), to better understand basic physiologic and pathologic processes (Laufman, 2002), and to revolutionize diagnosis through new imaging and scanning technologies. Such technological developments, however, demand that practitioners, managers, and policymakers are more responsible in assessing the appropriateness of new technologies (Hofmann, 2002).

The methods people use to communicate with each other have also changed significantly. Mobile telephony, electronic mail and videoconferencing offer new options for sharing perspectives. Digital technologies are making visual images and the voices of people more accessible through radio, TV, video, portable disk players and the Internet, which change the opportunities for people to share opinions, experience, and knowledge. This has been coupled with steps to deregulate the telecommunications and broadcast systems in many countries, which open up spaces and platforms, such as community radio, for increased communication.

Reliable information and effective communication are crucial elements in public health practices. The use of appropriate technologies can increase the quality and the reach of both information and communication. Increased information helps people to improve their own health. At the same time, social organizations help people achieve health through health care systems and public health processes. The ability of impoverished communities to access services and engage with and demand a health sector that responds to their priorities and needs is influenced by wider information and communication processes mediated by ICTs.

2.1 ICTs and the health-related MDGs

Health is at the heart of the MDGs, in recognition of the fact that health is central to the global agenda of reducing poverty as well as an important measure of human development (WHO, 2005). Three of the eight MDGs are directly health-related:

- Reduce child mortality (goal 4)
- Improve maternal health (goal 5)
- Combat HIV and AIDS, malaria, and other diseases (goal 6)

The other MDGs include health-related targets and reflect many of the social, economic, environmental, and gender-related determinants that have an impact on people's health. Achieving them will also contribute to improvements in the health status of millions of people around the world. These targets include:

- eradicating extreme poverty and hunger (goal 1);
- improving education (goal 2);
- empowering and educating women (goal 3);
- improving water and sanitation systems (a key component of goal 7); and
- improving international partnerships (among other things to improve access to affordable, essential drugs on a sustainable basis – goal 8).

The eight MDGs do not work in isolation and therefore cannot be treated in isolation. Policy efforts and discussions need to consider the broader health determinants that affect people's lives (WHO, 2005). UNICEF (1998), for example, has developed a conceptual model for child morbidity and mortality that considers the political, economic, and social systems that determine how resources are used and controlled. This helps to identify the number and distribution of children who do not have sufficient access to food, child care, clean water, sanitation, and health services. This type of analysis is applicable to other public health issues, such as HIV and AIDS, or women's health (Global Health Watch, 2005). Unless resources are also devoted to tackling the broader determinants of health, more health spending does not necessarily mean better health (Clemens and Moss, 2005).

The role that ICTs might be able to play in meeting the MDGs is summarized in Box 1. A comprehensive approach is required, both in terms of looking at issues that cut across different areas and also having private, government, and non-governmental organizations working together to achieve the same objectives (World Bank, 2003). ICTs need to work in synergy with any other policy initiatives or strategies, such as national poverty reduction strategies (Danida, 2005) or as part of national health policies.

Box 1. The role of ICTs in meeting the Millenium Development Goals

Many development institutions have explored the connection between ICTs and efforts to reduce poverty and achieve the other MDGs, including the Organization for Economic Cooperation and Development (OECD – 2003), the U.K. Department for International Development (DFID – Marker, et al, 2002), and the Swedish International Development Cooperation Agency (SIDA – Greenberg, 2005). The main conclusion of these and other studies is that ICTs, when incorporated effectively into development programs can be useful tools in efforts to reach the MDGs.

The World Bank (2003) argues that there is growing evidence of the ability of ICTs to:

- provide new and more efficient methods of production;
- bring previously unattainable markets within the reach of the poor;
- improve the delivery of government services; and
- facilitate management and transfer of knowledge.

SIDA adds that, increasingly, examples can be found "where the thoughtful use of ICTs has markedly addressed various aspects of poverty. Despite the various pitfalls associated with deploying ICT projects, there is growing

evidence that the use of ICTs can be a critical and required component of addressing some facets of poverty. It is quite clear that ICTs themselves will not eradicate poverty, but it is equally clear that many aspects of poverty will not be eradicated without the well-thought-out use of ICTs." (Greenberg, 2005)

At the same time, it is difficult, if not impossible, to establish '"proven empirical links" between the use of ICTs and the achievement of the MDGs. As the UN ICT Task Force (2003) points out: 'measuring the impact of ICT on health generally seems to be fairly difficult because there are obviously many other factors that impact health'.

Sources: The OECD (2003), DFID (Marker, et al, 2002), the World Bank (2003), and SIDA (Greenberg, 2005)

2.2 Building on evidence

The ideal for setting policy in any area is to rely on a strong evidence base of what does and does not work. In the case of ICTs and health, strong evidence-based information that draws on impact assessments or outcome measurements is not easy to find.

Published evidence currently available on the use of ICTs in health tends to be at the proof-of-concept stage. The idea of using a particular technology in relation to a particular medical condition or within an area of the health care system has been shown to work. However, it is harder to find examples of analysis that moves beyond the project purpose to look at the particular processes that might help achieve international development objectives – such as the MDGs – or to look at the conditions that might need to be in place to scale up the intervention and what might be the impact of such activity (Batchelor and Norrish, 2005). This is where it is essential to look also at analyses of pooled experience, consensus statements, and policies. This framework paper draws on both streams of knowledge to develop guidance and to identify gaps.

According to WHO (2004), "health technologies are evidence-based when they meet well-defined specifications and have been validated through controlled clinical studies or rest on a widely accepted consensus by experts."

Appendix 2 lists major systematic reviews of the evidence base for the use of ICTs in health over the past five years. Taken together, this demonstrates the level of evidence for specific uses of ICTs in health care. While most studies have been done in industrialized countries, they come from a variety of different situations and many of the conclusions could be applied in other settings.

Nearly all of the reviews indicate that there are useful applications for ICTs in health care. Some have been able to identify positive outcomes at the population level. Several also provide concrete suggestions for policymakers and donors. One of these suggestions is that policymakers should be cautious about recommending increased use and investment in unevaluated technologies.

The use of ICTs is also growing in many areas of health communication, including consumer, patient, and provider education; decision and social support; health promotion; knowledge transfer; and the delivery of services (Suggs, 2006).

2.3 Beneficiaries and intermediaries

In considering ICTs in health, it is vital to be clear about who the potential beneficiaries may be for various strategic options.

2.3.1 Beneficiaries

Potential beneficiaries of ICTs include various stakeholders in key health institutions, and in society as a whole in the developing world. It is clear from the literature that stakeholders in health institutions need to be clearly identified. It is important to examine individuals and groups within the key institutions in the health system as target beneficiaries of ICTs, and in doing so, to examine their capacities and needs, as well as. the potential for ICTs to assist in efficiency and effectiveness at each level in the system. These beneficiaries can be grouped as follows:

- International level: International agencies (WHO, UNAIDS), donor agencies, international non-governmental organizations (NGOs).
- Regional level: regional bodies – European Union (EU), New Partnership for Africa's Development (NEPAD), African Union, regional NGOs.
- National and provincial level: government ministries, national NGOs, national and provincial governments, provincial hospitals and health departments.
- Local level: personnel at health clinics, health workers, doctors, traditional healers, community leaders, patients and citizens.

Beneficiaries in health range from individual and collective groups of patients and health workers, to national and international policymakers. Strategies that address beneficiary needs, and are researched and investigated thoroughly have the greatest potential to succeed. Conversely, strategies that are not embedded in clear and realistic needs are vulnerable to failure due to lack of participation, acceptance, capacity and other enabling factors. Beneficiaries can also be viewed through the prism of location and access, with an urban/rural differential. ICTs can help expand access to health care from the urban to rural areas, connecting people to advice and information. This includes people being able to access their own health care information, and allowing health care workers in remote settings to get advice and support from colleagues who have access to better facilities and information sources.

A suggested tool for decision-makers in strategizing about target beneficiaries in general, and beneficiaries within key health institutions in particular, is to map out as many details about these targets as possible. This could include the range of roles at each level within the target institutions, the capacity of the stakeholders compared to the necessary capacity required for different types of ICT intervention. It is also highly recommended to map the short, medium, and long-term vision for sustainability of the ICT intervention within the target beneficiary group. *(Please see 'Appendix 1:tools and resources' for examples of templates for mapping).*

2.3.2 Intermediaries

Intermediaries are those who facilitate health service provision, information, and communication for people who may be professional or non-professional, part of the community, or outside the community. The one unifying aspect of intermediaries is that they are links between higher-level technical staff and people at the grassroots. Intermediaries include:

- communication intermediaries, such as radio personnel and other local media;
- health service intermediaries, such as local health workers and clinic staff; and

- advocacy and campaigning intermediaries (who are conduits between policymakers and the grassroots and visa versa).

Effective intermediaries in health require training in order to use the technology to create effective interactions. ICTs are not simply neutral conduits of technical information, but require skilled and sensitive communicators to facilitate interactions.

2.3.3 Key lessons

These are some of the key lessons about intermediaries and beneficiaries of ICTs in health:

- Each level of beneficiary needs to be considered in terms his or her needs, capacity, location, and access within an urban/rural differential.
- Intermediaries need to have the capacity to take on the new ICT innovation. Without this capacity, the innovation will not translate into an embedded and sustainable benefit.
- Before an ICT strategy is implemented, the target beneficiaries need to be clearly identified and their needs clearly mapped, preferably by using a participatory approach.

3. Using ICTs in the health sector

According to WHO, the use of ICTs in health is not merely about technology (Dzenowagis, 2005), but a means to reach a series of desired outcomes, such as:

- health workers making better treatment decisions;
- hospitals providing higher quality and safer care;
- people making informed choices about their own health;
- governments becoming more responsive to health needs;
- national and local information systems supporting the development of effective, efficient, and equitable health systems;
- policymakers and the public becoming more aware of health risks; and
- people having better access to the information and knowledge they need for better health.

The evidence regarding ICTs in health is usefully viewed with reference to the key aspects of the WHO e-health strategy, summarized in Table 1.

Table 1: Key aspects of the WHO e-health strategy

Policy - Ensure public policies support effective and equitable e-health systems. - Facilitate a collaborative approach to e-health development. - Monitor internationally accepted goals and targets for e-health. - Represent the health perspective in international gatherings on major ICT issues. - Strengthen ICT in health education and training in countries, supporting a multilingual and multicultural approach.
Equitable access - Commitment by WHO, Member States, and partners to reaching health communities and all populations, including vulnerable groups, with e-health appropriate to their needs.
Best use - Analyze e-health evolution, impact on health; anticipate emerging challenges and opportunities. - Provide evidence, information and guidance to support policy, best practice, and management of e-health systems and services. - Identify and address needs for e-health norms and standards, innovation, and research.

Source: World Health Organisation (WHO), 2004.

ICTs have been used in various ways to help achieve outcomes such as these. Table 2 sets out some of the potential uses identified by Pagliari and her colleagues in 2001.

Any health system needs to rest on basic pillars. These are four key ones identified by the Disease Control Priorities Project in its latest publication, Priorities in Health (Jamison, 2006):

- Information, surveillance, and research.
- Management of health services.
- Human resources.
- Financing.

Clearly each of these pillars can benefit from the use of ICTs. In practice, the use of ICTs in the health sector has tended to focus on three broad categories that incorporate these pillars:

1. **improving the functioning of health care systems** by improving the management of information and access to that information, including:
   - management of logistics of patient care,
   - administrative systems;

- patient records; and
- ordering and billing systems.

2. **improving the delivery of health care** through better diagnosis, better mapping of public health threats, better training and sharing of knowledge among health workers, and supporting health workers in primary health care, particularly rural health care, including:
   - biomedical literature search and retrieval;
   - continuing professional development of health workers;
   - telemedicine and remote diagnostic support;
   - diagnostic imaging;
   - critical decision support systems;
   - quality assurance systems; and
   - disease surveillance and epidemiology.

3. **improving communication about health**, including improved information flows among health workers and the general public, better opportunities for health promotion and health communication; and improved feedback on the impact of health services and interventions, including:
   - patient information,
   - interactive communication,
   - media approaches,
   - health research, and
   - advocacy to improve services.

Each of these three categories will be explained in more detail in the following pages with examples of practice and key lessons and recommendations.

Table 2: Potential uses of ICTs in the health sector and issues that may emerge

What issues currently dominate e-health? What is going on in e-health?			**What emerging technologies are likely to impact on health care?**	**How does research inform e-health?**	**How do developments in e-health inform research?**
Professional Clinical Informatics - Decision aids for practitioners (prompts, reminders, care pathways, guidelines) - Clinical management tools (electronic health records, audit tools) - Educational aids (guidelines, medical teaching) - Electronic clinical communications tools (referral, booking, discharge; correspondence, clinical email/second	**Electronic Patient/Health Records (EPR, EHR)** - Electronic medical records. Record linkage. The Universal Patient Indicator. Databases and population registers. - Achieving multiprofessional access. Technical and ethical issues. - Data protection/ security issues - Patient access and control - Integration with other services	**Consumer Health Informatics** - Decision aids for patients facing difficult choices (genetic screening) - Information on the Web and/or digital TV (public information and educational tools for specific clinical groups) - Clinician-patient communication tools: 1. Remote: Clinical e-mail and Web-based messaging systems for	**New Technologies** - Satellite communications (for remote medicine) - Wireless networks (within hospitals, across geographical areas) - Palmtop technologies (for information, for records) - New mobile telephones - Digital TV (for disseminating health information & communicating with patients) - The WWW and its applications for health (issues: quality control, confidentiality, access) - Virtual reality (remote/	**Research Input** - Development - Need for user involvement in product conception, design and testing. Iterative development. Needs assessment, accessibility and usability research. Multi-faceted expertise required. - Implementation – Understanding people and organizational factors, system acceptability, resistance to change. Use of tailored implementation	**Research Outcomes** - Potential of electronic databases such as population registers for epidemiological research. - Research into the impact or use of informatics tools suggests appropriate and cost-effective priorities for policymakers. - Areas of cross-over (bioinformatics)

What issues currently dominate e-health? What is going on in e-health?			What emerging technologies are likely to impact on health care?	How does research inform e-health?	How do developments in e-health inform research?
opinion, laboratory test requesting/results reporting, e-shared care) - Electronic networks (disease-specific clinical networking systems) -Discipline/disease-specific tools (diabetes informatics) - Telemedicine applications (for interprofessional communication, patient communication and remote consultation) - Subfields (nursing & primary care informatics)	(social work, police) - Clinical coding issues (terminologies) **Healthcare Business Management** - Billing and tracking systems - Audit & quality assessment systems	consultation, disease monitoring, service-oriented tasks (appointment booking, prescription reordering). 2. Proximal: Shared decision making tools, informed consent aids 3. Mixed: On-line screening tools (for depression) and therapeutic interventions (cognitive behaviour therapy) - Access and equity issues (data protection issues, the Digital Divide) - Quality issues for health information on the net - "virtual" health communities	transcontinental surgery) - Nanotechnology - Intersection of bioinformatics and health informatics.	strategies. - Innovative methods for mapping functional and technology needs, place of systems in the organization - Knowledge management, systems approaches, communication networks models, organizational development to map pathways. - Evaluation Formative, as above, also: Outcome assessment to establish impact of new systems on clinical outcomes, processes and costs	

Source: Adapted from Pagliari, et al. 2001.

3.1 Improving the functioning of health care systems

Health systems are very complex. So too are the types of processes and information needs that are handled in health care systems. To be useful, information systems must capture and process data with broad diversity, scope, and level of detail.

The nature of health care systems, particularly as regards information, is markedly different from most other sectors. In banking, for example, there are limited terms used, limited transaction possibilities, and simple information needed about customers, and well established standards for data exchange among banks so that most transactions can be performed at automated terminals by the customers themselves.

The options for information systems within health care are much more complex due to the array of data types. For example, the automation of patient records must deal with a variety of data requirements and specification problems found in many health care data types which are exacerbated by the size and complexity of the medical vocabulary, the codification of biomedical findings, and the classification of health conditions and interventions. Nomenclature issues include concepts such as procedures, diagnoses, anatomical topography, diseases, aetiology, biological agents such as classification of micro-organisms,

drugs, causes for health care contact, symptoms and signs, and many others. Possible combinations and detailing represent a staggering number of possible identifying coding requirements.

Information systems within the health care system – patient records, tracking of disease prevalence, monitoring drug supplies, maintaining ordering systems for supplies, billing procedures – all stand to benefit from the use of ICTs. ICTs are the basis for the development and operation of information systems and enable the creation and application of knowledge. Information systems function at many levels of sophistication and complexity — from very specific to very general.

Example 1 gives three examples of information systems that have been developed in South Africa. One is stalled, one has been reasonably successful and the third failed completely, according to its evaluation team (Littlejohns, et al, 2003). All three examples illustrate the need to:

- pay attention to past experience;
- involve users in the planning and design of the system;
- build information cultures;
- strengthen capacity of users;
- set realistic goals; and
- focus on the benefits of the system, rather than the technology.

Example 1: Developing health information systems in South Africa

1. A National Health Care Management Information System (NHC/MIS) was designed to cover medical records, patient registration, billing and scheduling modules in select hospitals in all nine provinces. Most provinces have minimum patient records. The National Health Information System Committee of South Africa (NHISSA) has prioritized the standardization of the Electronic Health Record. The South African Department of Health (DoH) is working with the Home Affairs National ID System (HANIS) Project to incorporate its data elements onto a smart card being developed by the project. The information will include: a minimum patient record, which includes ID verification; blood group; allergies; donor status; last ten diagnoses, treatment, prescriptions; and medical aid. Reliance on the HANIS system is perhaps questionable, however, since it has been in the pipeline for a number of years without any meaningful progress.

2. The South African District Health Information System (DHIS) was launched in 1998 in all provinces. This was the first systematic data-gathering tool that could be used to identify public health issues. It enabled all the 4,153 public clinics to collect information on ten national health indicators. DHIS is facilitated by the Health Information Systems Programme (HISP). On completion of a three-year pilot project in the Western Cape the HISP model (comprising training methods, data-handling processes, and software tools) resulted in the development of a co-ordinated strategy following acceptance and endorsement as the national model by NHISSA in the latter half of 1999. The HISP approach to the development of a DHIS, is based on a six-step implementation model: Step 1 – establishment of district information teams, Step 2 – performance of an information audit of existing data handling processes, Step 3 – formulation of operational goals, indicators and targets, Step 4 – development of systems and structures to support data handling, Step 5 – capacity building of health care providers, and Step 6 – development of an information culture. The HISP model has been exported to other countries, including Mozambique and Cuba.

3. The South African province of Limpopo has 42 hospitals (two mental health facilities, eight regional facilities and 32 district facilities). The area is one of the poorest in South Africa. The overall goal of the project was to make use of information systems to improve patient care, the management efficiency of hospitals and generally increase the quality of service. Among the functions of the proposed information systems were: master patient index and patient record tracking; admission, discharges and transfers; appointments ordering; departmental systems for laboratory, radiology, operating theater, other clinical services, dietary services and laundry; financial management; management information, and hospital performance indicators. Introduction of the systems ran well over time and budget and were implemented only in some of the hospitals. Major factors identified as contributing to the failure of implementing this system (which are likely to apply to other situations), included: failure to take into account the social and professional cultures of healthcare organizations and to recognize the need for education of users; computer staff underestimation of the complexity of routine clinical and managerial processes; different expectations among stakeholders; the long process of system implementation of systems in a sector where managerial change and corporate memory is short; and failure of developers to identify and learn lessons from past projects.

Source: Electronic Government, Issue 2, Vol. 1, 2004:31; www.hisp.org. South African Health Example, 5Review 2001, ftp://ftp.hst.org.za/pubs/sahr/2001/chapter6.pdf; Littlejohns, et al 2003.

All three project examples were “big” projects – covering an entire province or across the country. A clear lesson about big information system projects is that they should actually start small ─ as pilots or prototypes ─ with careful monitoring and assessment to test out the challenges and issues that are likely to emerge. This is one of the major conclusions of a project to use telephones and the Internet to improve the administration of appointments for people attending the 168 first-level health care centers of the Social Security and Services for the State Workers Institute (ISSSTE) in Mexico (Rodriguez-Aleman, 2003). Several factors helped increase ownership, acceptance, and use of the system, including careful planning, regular involvement of, and communication with stakeholders, and enabling local initiatives and adaptations to the overall plan.

In Bangladesh, a project with a different scale was developed to register, schedule, and track immunization of children. Based in the city of Rajashahi, a computerized system was introduced to replace a manual record-keeping system (Ahmed, 2004). Over a period of three years, the new system was able to increase immunization rates from around 40 percent to more than 80 percent. A critical reason for the project’s success was that it was designed to meet the interests and needs of various stakeholders, and to provide them with

tangible benefits. The project reduced the time health workers spent searching records; made it easier for managerial staff to supervise the immunization system and monitor performance; and improved immunization protection for children and ultimately their health, benefitting all the families reached by the system.

Fundamental to the effective use of ICTs is the concept of added value – all participants must get out of an information system at least as much as they put in. The system must generate benefits greater than its cost; otherwise it becomes a burden. Information systems are almost totally dependent upon the staff that provide and record the information, yet the staff is usually the lowest valued and least involved. If the benefits of their contribution are not evident to the staff, there is a high probability of building inaccuracy, instability, and future failure.

It is important to remember that the context in which ICTs in healthcare systems operate, the clinical patterns they support, and the policy environment will all change constantly, and the information systems must respond to these changes. New opportunities will arise, which should be exploited when cost-benefit analysis shows this to be justified. Monitoring and evaluation of information systems and other ICT interventions enables adjustments to be made according to how the changes are perceived, and how they change practice.

3.1.1 Key lessons

Here are some of the key lessons in this brief review of the literature and analysis about the role and potential of ICTs in improving the functioning of health care systems:

- An effective approach to setting up information systems is to explicitly identify the objectives of the system and determine the expected results.
- For maximum potential success, an ICT project requires all participants (from the developers of the system to the users and beneficiaries) to view the innovation as adding value to existing systems. If the people using the system do not like, want, or support it, it will likely fail.
- Information systems should never become static or they will lose their value.

3.2 Improving health care delivery

Integrating the use of ICTs into existing health systems has helped to improve the delivery of health care in a number of ways (Rodrigues, 2000a, 2000b; PAHO, 2001). These include:

- the use of telemedicine to improve diagnosis and enhance patient care;
- improvements in the continuing professional development of health workers and better sharing of research findings; and
- efforts to extend the reach and coverage of health care to make an impact on specific conditions.

3.2.1 Telemedicine

Telemedicine is a growing field. According to the International Telecommunication Union (ITU, 2005), telemedicine is a powerful tool for improving health care delivery that has been successfully implemented in pilot projects in many countries. Appendix 2 includes references to many studies describing the impact of telemedicine interventions. Many of these pilots clearly demonstrate proof of concept – telemedicine can improve diagnosis and treatment of specific conditions.

Although telemedicine can be highly effective, a SIDA report (Greenberg, 2005) notes that cost is an issue: “in its high-tech implementations, it is unlikely to be cost-effective or affordable in widespread use. Those implementations requiring high bandwidth and

sophisticated remote equipment have generally proven practical in cases where money is not an issue or as an alternative to high-cost air transportation and lodging."

Used wisely, however, telemedicine can be a cost-effective method that richer countries can employ to aid capacity building in the health care systems of poorer countries. (Johnson, et al. 2004). A study on the use of teleophthalmology found that the technology transfer was effective in reducing the burden of eye disease and that practitioners in South Africa also learned novel procedures that could help future patients and improve cost-effectiveness. The use of teleconsultations has been assessed in a number of specialties (Campenella,et al, 2004). Some, such as laboratory, dermatology, and cyto-pathology teleconsultations, are not time consuming and are reliable. The effectiveness and cost-benefit of teleconsultations in cardiology and radiology are disputable.

Telemedicine piloting is well advanced in Latin America. A number of case studies on these pilots contain information that can be informative for scaling up projects. These include the use of distance education to encourage breastfeeding (de Ornes et al, 2002), the use of telemedicine in rural areas to improve maternal health (Martinez, 2005), and an exploration of how the Internet can be used in urban areas to contribute to the prevention of mental health (Finquelievich, 2000).

In Africa, most people are based in rural areas, and their health care is sparse. Yet the epicentre of health care expertise and resources in Africa remains in the cities. The result is that the people come to towns and cities for their health care in huge numbers and at enormous cost. ICTs are beginning to be used innovatively to bring health care to the people in a more effective manner. Telemedicine is one way this can be done, as the example from the Africa Medical and Research Foundation (AMREF) telemedicine project indicates (see Example 2).

Example 2: AMREF – Using telemedicine to improve rural health

AMREF is improving its clinical outreach program with the help of telemedicine. Many sites have been set up to test the approach and gradually expand it across nearly 80 rural hospitals currently served by AMREF across East Africa. The AMREF telemedicine project provides expert second opinion to clinicians in those hospitals supported by the AMREF outreach programme. The primary goal is to improve the quality of and access to specialist care. The secondary goal is to improve care through training using teleconsultation and CME courses. An AMREF clinician and physicians consult on specific cases. Clinical staff from the rural hospital use e-mail to forward the case notes and supporting images of the patients to be seen the following day. Notes may be scanned images of handwritten notes or PC-based using proprietary software. Digital images of the patient, digital images and/or video clips of any visible lesion, and digital images of X-rays can accompany the notes together with the results of any other diagnostic procedures. The outreach clinic accesses the Internet for transmission of the clinical notes and attachments, and begins the virtual consultation.

Consultants meet to prepare opinions and at an agreed time a teleconferencing connection will be established. On completion of the consultations, the entire record is saved on a dedicated library file on the AMREF server. In this way, AMREF helps link thousands more patients in remote areas every year with services and skills in an increasing number of hospitals in Eastern Africa.
Source: www.amref.org

The examples cited here and the experience elsewhere demonstrate that telemedicine helps countries deal with shortages of health care professionals through better coordination of resources; builds links between well-served and underserved areas of the country; helps link health workers to the latest research and information; and can enhance sharing of experience and professional development. ITU (2005) notes that telemedicine is more than the delivery of hardware and software. Incorporating already-existing technology – such as phone or e-mail – into medical practice and routine consultancies can make a difference.

3.2.2 E-learning

In a key paper produced as part of a global review on access to health information, Godlee et al (2004) concluded that "universal access to information for health professionals is a prerequisite for meeting the MDGs and achieving Health for All. However, despite the promises of the information revolution, and some successful initiatives, there is little if any evidence that the majority of health professionals in the developing world are any better informed than they were 10 years ago. Lack of access to information remains a major barrier to knowledge-based health care in developing countries (as well as in many parts of the 'developed' world). "

Using ICTs effectively offers the promise of changing this situation for health workers. One attempt to improve access to information has been undertaken by WHO and the United Nations Development Programme (UNDP) in India (see Example 3). Key lessons emerging from this project that are relevant to many other initiatives to increase access to basic health information deal with connectivity, capacity, and content. For example, some of these lessons indicate that:

- connectivity took longer to establish than anticipated;
- local capacity needed to be strengthened in terms of both project management and the use of ICTs; and
- content and format of the information needed to be relevant to users' lives and needs, and available in local languages is vital to many community health workers.

A major concern for this project was the need to ensure that already-existing inequalities in health information access were not exacerbated by the introduction of ICTs. Project managers found that a strategic approach was needed to reach health workers less likely to have access to the Internet and computers skills (women, lower-ranked professionals).

Example 3: Improving access to information in India

The Health InterNetwork (HIN) India project (www.hin.org.in) was launched in 2000. This pilot project was designed to document and assess the impact of ICTs on the flow of reliable, timely, and relevant information for health services provision, policy making, research, and to evaluate and better understand the challenges of improving the flow of and access to relevant health information in developing countries. It worked with local organizations to ensure relevance and sustainability.

The project introduced ICTs into seven primary health centers and three community health centers, and upgraded computers, Internet connection, and networks in four research institutions and two medical colleges. A basic package consisted of a desktop computer, printer, scanner, electrical and telephone connection, and a subscription to an Internet service provider.
Source: http://www.rho.org/html/ict_progexamples.htm#india

In Nepal, the unique ability of radio to reach, entertain, and educate isolated, less-educated, rural health workers and communities made it an ideal medium for attempting to improve the quality of health services and support the continuing medical education of grassroots health workers (see Example 4). Radio reaches service providers living in isolated communities in difficult terrain and gives them a chance to receive standardized instruction in an appealing format. This initiative highlighted the importance of:

- undertaking a comprehensive needs assessment;
- ensuring stakeholder involvement in the process; and
- strategic planning.

It also demonstrated that it is possible to combine an entertaining story with accurate and updated technical information, as the format involved radio dramas.

Example 4: Distance education radio for health workers in Nepal

The Radio Communication Project (RCP) used two radio drama serials and several reinforcing components. 'Service Brings Reward' was an entertainment distance education program aimed primarily at 15,000 grassroots health workers. 'Cut Your Coat According to Your Cloth' was aimed at the general public to improve public perception of health service providers and increase demand for services. These programs followed a mutually reinforcing approach by simultaneously increasing provider skills and client demand for services.

The technical content of the distance education serial was based on the Nepal Medical Standards guide. Reinforcing components included print materials (program guide, reference manuals, posters, wall hangings, calendars, method-specific brochures and flipcharts) and interpersonal communication and counselling training. The RCP incorporated messages about the well-planned family; conception and contraception; modern contraceptive methods; the role of the caring husband; communication and counselling; maternal and child health; HIV/AIDS; immunization; and adolescent reproductive health. A guiding principle of the RCP was message consistency across the various communication channels and audiences. A systematic and participatory process was used to ensure that appropriate, accurate, and consistent content was incorporated into radio drama serials, as well as the interpersonal communication and counselling and print components. All the stakeholders (government, INGOs, NGOs, technical experts, writers, producers and audience members) met to produce the design document that detailed the content of each radio program episode, responsibilities for different aspects of the project, a production and implementation schedule, and an evaluation strategy.
Source: Adapted from a case study by Diane Summers in Ballantyne, 2002

Another way to reach out to those not usually included is through the electronic networking, as exemplified by the Health and Development Networks (HDN – see Example 5). Electronic networking is a valid and viable means of providing learning and dialogue; highlighting issues; and creating virtual conferences among those who cannot attend in person, at a fraction of the cost of conventional meetings. These forums can, and do, effectively attract participation from people in developing countries, despite issues of electronic connectivity and access. The key skills required are good facilitation and moderation skills. The content exists, and is shared on a daily basis at exclusive events, meetings, and workshops. Electronic processes can bring this content out into broader forums, so that it can have an influence on daily practices, as well as wider audiences, such as policymakers and international organizations.

Example 5: Electronic networking and communication support on HIV and AIDS

Home and Community Care (HCC) plays a vital role in providing acceptable, essential, quality care and support to people with HIV and AIDS. Limited attention has been given to HCC in the past at all levels - especially in international discourses. Grassroots workers seldom have a voice at the international level - thus expertise and lessons learned in the field are seldom shared. While international conferences provide opportunities to share lessons, there is often little continuity between them, and the discussion is limited to the few able to attend such events. The Insight Initiative project provided electronic networking and communication support to two regional events, spanning two continents: southern Africa and Asia and the Pacific. This project used electronic networking as a means to increase the number of voices and perspectives in the preparation and follow-up to the two events, and to facilitate exchange of relevant content between the southern Africa and Asia Pacific regions. The aim was to ensure that as many voices as possible were heard and had the opportunity to participate in the conference, especially those who could not attend in person. Two specific time-limited, moderated, and structured discussions related to the conferences (2 and 7 months respectively) were held using the ProCAARE e-mail discussion forum. (ProCAARE is a discussion forum managed by SATELLIFE, the Harvard AIDS Institute, and Health & Development Networks.) A new theme was introduced every month. The moderation team introduced each new theme with a set of clearly designed questions, aimed to guide and focus the discussions. In addition, 26 key correspondents from Asia, Africa, Latin America, and Eastern Europe were recruited to write articles that fed into the conference discussions, as well as provide session coverage from the actual events. During the conferences, the team worked intensively to provide critical analyses on the presentations, and get participants' views on what was presented. Following the events, post-conference, structured discussions were organized during which conference coverage, local content, and emerging issues around HCC were discussed, evaluated, and put forward for further attention. Continuity was facilitated between the two events. Using innovative methods, including deliberative dialogue, to stimulate and engage people, the active participation in the discussion was unprecedented in HDN's experience. This was illustrated by its extensive regional coverage, including contributions from Asia, Africa, Latin America, and the United States, and its generation of a wide range of content and views from communal, institutional, and individual perspectives. Participation increased from 700 to just under 2,500 over 6 months.
Source: Adapted from a case study by Tim France in Ballantyne, 2002

Health workers involved in primary health care in developing countries are often isolated. They work in remote settings, often alone, and have little or no access to up-to-date information and opportunities to exchange experiences with colleagues. This situation is beginning to improve as health workers make better use of existing technologies and learn to use new technologies. In Ghana, Kenya, and Uganda, Satellife has been building experience around the use of personal digital assistants (PDAs) – small handheld devices that enable health workers in remote settings to gain access to information; capture, store and share important health data; and link to the experiences of other colleagues to improve their practices and the outcomes for their patients. Example 6 summarizes some of this experience.

Example 6: Using PDAs in Africa – Satellife's experience

In Ghana, community volunteers have been using PDAs to collect data as part of a measles vaccination program. In Kenya, medical students were equipped with PDAs loaded with relevant information about their studies in obstetrics/gynecology, internal medicine, and pediatrics. In Uganda, practicing physicians were given PDAs containing basic reference material as part of their continuing medical education.

The Ghana project yielded compelling evidence of the value of PDAs for data collection and reporting. Data from 2,400 field surveys were submitted to the implementing agency by mid-day following a vaccination campaign in a particular location. They were analysed, and a report was prepared for the Ministry of Health by the end of the day. Previously, data entry would have taken 40 hours using paper and pencil surveys.

The Kenya and Uganda pilots demonstrated the value of using PDAs for information dissemination. In Uganda, 95 percent of physicians reported that using the reference materials over a three-month period improved their ability to treat patients effectively. This included improvements in diagnosis, drug selection, and overall treatment. In Kenya, the majority of students actively used the treatment guidelines and referred to the medical references and textbooks stored on the PDA during their clinical practice.
Source: Satellife, 2005

Another use of technology in Uganda has had an impact on maternal mortality. The Rural Extended Services and Care for Ultimate Emergency Relief (RESCUER) pilot project in eastern Uganda made use of a VHF radio and mobile walkie-talkies to help empower a network of traditional birth attendants, to partner with the public health service centers to deliver health care to pregnant women. This resulted in increased and timelier patient referrals, as well as the delivery of health care to a larger number of pregnant women (Musoke, 2001). It also led to a reduction in maternal mortality from 500 per 100,000 in 1996 to 271 per 100,000 in 1999.

Two strong messages that come through in the experiences highlighted in this section: There is a need to ensure that ICT use in the health sector reaches out to the poorest populations and there is a strong focus on linking rural, remote, difficult environments that are underserved with the resources that are located in the central health services.

Danida (2005) – and others – argue that ensuring that people living in rural areas are the major beneficiaries in ICT initiatives will help meet the MDGs including those related to health. However, a recent Food and Agricultural Organization (FAO-2003) report points out that "there has been virtually no progress in making the Internet available in the least developed countries, especially in the rural areas." More MDGs can be addressed by including rural populations in the group of beneficiaries of ICT initiatives in the health sector, as the rural poor constitute the most vulnerable population group. Roughly 75 percent of the world's poorest live in rural areas. Health conditions in rural areas are generally poorer, and access to information, services and supplies is most limited. Implementing ICT initiaitives probably means encouraging intermediaries, such as NGOs, health educators, academic institutions, or local entrepreneurs, to act as conduits for information available via technologies such as the Internet, and the poor, through translation, adaptation and use of more traditional means of communication.

3.2.3 Key Lessons

These are some of the key lessons in this brief review of the literature and analysis about the role and potential of ICTs in health care delivery:

- Telemedicine provides benefits of resource coordination, urban/rural linkages, and connecting remote health staff to centralized health expertise and resources.
- Incorporating already-existing technology, such as phone or e-mail, into medical practice and routine consultancies can make a significant difference.
- While there is still limited evidence of improved access to learning in the developing world, there is strong potential for e-learning in health as demonstrated by a variety of successful small projects around the world.
- Multiple ICT routes can, and are, being used for e-learning in a mixed toolbox approach (for example, using Internet, radio, SMS, PDAs and print materials).

3.3 Improving communication around health

People absorb new information, ideas, and approaches by making sense of them in terms of their own local context and social, economic and cultural processes. They assimilate, adapt, and incorporate them into their daily realities in ways that help them better deal with the local situation. ICTs present a range of opportunities for the delivery of health information to the public, and for developing greater personal and collective communication. Commentators view ICTs as also representing a way for health workers to share information on changes in disease prevalence and to develop effective responses. They provide opportunities to encourage dialogue, debate, and social mobilization around a key public health concern. However access remains an abiding issue, particularly in developing countries (Shilderman, 2002).

Approaches that are being used for any of these purposes include:

- developing Internet information portals;
- using mass media to broadcast widely;
- developing interactive programming on broadcast media;
- making more effective use of existing communication systems; and
- developing community access points (CAPs).

3.3.1 Information via the Internet and other ICT media

ICTs are presenting health communicators, media, and other stakeholders with a range of new and stronger opportunities for health information dissemination. Whether this dissemination is effective or not requires further analysis, but the actual mechanisms for distributing health information and debate have clearly been expanded by the advent of ICTs.

Information and communication via the Internet

There are increasing numbers of health-focused portals and information sites aimed at providing information to consumers as well as sites dedicated to health workers, individuals and a range of health-related communities of interest.

Patient focused

Navigating these information sites and determining which are worthwhile is becoming an increasing challenge for patients and health workers alike. A systematic review of "Web-based therapies" intended to encourage an individual's behaviour change found that 16 of 17 studies revealed the outcomes of improved knowledge and/or improved behavioral outcomes for participants using Web-based interventions (Wantland, 2004). Outcomes included increased exercise time, knowledge of nutritional status, and slower declines in health. Bessell and her colleagues (2002) concluded from another systematic review that there were

some positive effects on health outcomes from the use of information sites on the Internet. However, much of this was based on anecdotes and opinion rather than well-designed controlled studies. Schloman (2002) concluded that because of the amount of information and the immediacy of access to it (for those with connectivity), the issue of quality of information was important. She highlighted several rating systems that had been used but identified methodological problems with many of the approaches. She suggests that health workers have an important role to play in educating patients to be critical users of the information they find on the Internet. Godlee and her colleagues (2004) make the point that health workers too "need critical appraisal skills to be able to distinguish unreliable from reliable sources of information."

General focus
There is a growing number of sites and portals directed at general public audiences or at particular groups of users, such as people living with HIV and AIDS, or media professionals who want background information and data for health reporting. Many international NGOs have recognized the potential of the Internet for extending traditional communication projects, as well as for developing new approaches; such as providing resources for communications online. There is a need for policymakers to share learning and to collaborate around HIV and AIDS communication e-resourcing to maximize this avenue of media support.

Information and communication via ICT-enabled media
ICTs can also be used to raise awareness of an issue, develop dialogue within a community, increase demand for services, and encourage people to seek support and accurate information as demonstrated by the experiences of a group (Puntos de Encuentro – Meeting Points) in Nicaragua (see Example 7). The group made use of TV, radio, print and oral communication techniques to generate greater understanding about HIV and AIDS. This echoes the experience of the type of health promotion work done by agencies such as Soul City in South Africa (see http://www.soulcity.org.za, or Health Unlimited in Rwanda and Cambodia (see: http://www.healthcomms.org/comms/integ/ld-radio-oct05.html).

In all of these cases, there was reinforcement and deepening of the issues; emotional identification created through the characters, formation of alliances; and local skill-building in order to achieve a longer-lasting impact. A key lesson emerging was the that it takes time to do this effectively and it is never a straightforward process, but a set of successive steps. The process of assimilating new information takes time. Exploring issues in depth and detail rather than changing themes constantly allows people the time to engage with the information and internalize it.

Example 7: Multi-media health promotion in Nicaragua

Somos Diferentes, Somos Iguales (We're Different, We're Equal) is a multi-media/multi-method strategy that promotes the individual and collective empowerment of young Nicaraguan people to defend and exercise their human rights in daily life. The center of the strategy is a TV series, *Sexto Sentido.* This is complemented by a daily youth talk radio show, and combined with interpersonal and community reinforcement, through alliances with more than 200 organizations around the country; face-to-face capacity-building activities with grassroots youth leaders and local journalists; a methodological manual for workshops with young people; distribution of educational resource packs for use by local groups; help in setting up of peer-led support/discussion groups; alliances with more than 70 local TV and radio stations to expand coverage and debate; periodic thematic campaigns organized and carried out in conjunction with hundreds of local organisations, service providers and media outlets all over the country; and ongoing monitoring, evaluation, and dissemination of the results.
Source: Adapted from a case study by Humberto Abaunza Gutiérrez in Ballantyne, 2002

3.3.2 Increasing effectiveness of communication systems

ICTs such as Geographical Information Systems (GIS) can facilitate health sector planning, and help predict and identify the spread of emerging disease conditions. In Bangladesh, for

example, GIS data has been used to warn the health authorities about the likely location and spread of cholera in coastal areas. In India, the Malaria Research Centre in New Delhi has used images from India's remote sensing satellites to map areas where a malaria-carrying mosquito was likely to be found on the basis of ecological factors conducive to its breeding and survival. Their model correctly predicted exact breeding locations, which were then targeted for specific control measures. An estimated 50 million inhabitants were at risk from this mosquito, whose presence was in some cases unknown to the health authorities until the satellite aided study was carried out (Anon, 2005). Also in India, the private company, Voxiva, has been working with health authorities to make use of existing communication systems to develop more effective surveillance information in the aftermath of the 2004 tsunami.

Example 8: Developing quick responses in India

In Tamil Nadu state, a Health Watch programme was launched in May 2005 that allows health workers, even in remote areas, to immediately report disease incidence data to health officials. In turn, health managers can quickly analyze information about suspected cases, share technical information and resources, and initiate an informed response.

By linking Primary Health Centers with district health experts and programme managers, activities can be coordinated more effectively and resources (supplies, technical personnel, and transport) can be allocated more efficiently. During the implementation, Voxiva trained more than 300 doctors from Primary Health Centres using simple, easy to use bilingual manuals and interactive sessions. The training sessions were coordinated with the state to reinforce disease surveillance guidelines and outbreak response protocols.

The phone- and Web- based data collection and communication system strengthens Tamil Nadu's disease surveillance capabilities at the district and sub-district levels. The approach makes use of existing communications infrastructure: mobile phones, fixed line, and the Internet.
Source: Voxiva, 2005b

In Africa, the Uganda Health Information Network (UHIN) has been making use of PDAs to provide early warning information about the spread of communicable diseases such as measles or cholera, as the following example describes.

Example 9: Preventing Illness in Uganda

Veronica is a midwife in the Rakai District in southern Uganda. She uses her PDA for her work and for her community. She travels to the wireless router that stores the surveillance report for the entire district and where she uploads reports from the rural health clinic where she works. She also can download news and medical information. If there is an outbreak of measles somewhere in the district, she will learn of it before it reaches her community. She can advise people how to prevent catching it. Equally, if her report shows a local rise in cholera, the district will review her data and send medications and specialist assistance to help out. It used to take six months before the district would respond to this type of distress message, if at all.

The data collection aspect of this initiative was particularly successful. The overall process was four times as effective as manual data entry. Even with the costs of hardware and software, it was still 25 percent more effective.
Source: Rich Fuchs, Satellife, 2005; Greenberg, 2004

3.3.3 Greater access to communication tools and opportunities

ICTs are also being used to improve access to communications for health centers and the communities they serve.

Community access points
Research in Zambia, Botswana, and Mozambique found that access to information about HIV and AIDS was a major concern (Geers and Page, 2005). Recognizing that it was not possible to provide individual access to such information, the study recommended developing community access points (CAPs) which could act as HIV and AIDS "knowledge

centers." telecenters, and local service providers. Use of such services could be increased by either basing or placing such centers close to primary client organizations – those that were likely to make extensive use of the service – such as the media, schools, and health clinics.

Community telephones
Another form of community access comes from the avavilability of village-level mbile phones. In Bangladesh, for example, such phones have helped increase household income and led to improvements in food security, as well as investment in health and education (see Example 10). While not directly targeted at the health sector, the Bangladesh example demonstrates the way an integrated approach to using ICTs can contribute to the achievement of several MDGs – reduction of poverty and hunger, access to basic education, improvement in child health – at the same time. Similarly, reducing illness can have a very direct impact on livelihoods. Every day that is not spent being ill or taking care of a child sick with a recurring disease such as malaria can be used productively (Greenberg, 2005). Identifying ICT programs that can have impact in different sectors or deal with multiple determinants of health are likely to be more effective.

Example 10: Creative use of phones in Bangladesh and Uganda

In rural villages in Bangladesh where no telecommunications service has previously existed, Grameen's Village Phone program provided mobile phones to very poor women who use them to operate as a business. The benefits to both the operator and the community have been tremendous. The typical "village phone lady" has an average income three times the national average.

A study commissioned by the Canadian International Development Agency (CIDA) concluded that the Grameen Village Phone program yields "significant positive social and economic impacts, including relatively large consumer surplus and immeasurable quality of life benefits." Users of the phones can save from 3 to 10 percent of their household incomes by gaining better prices for the sale of goods or from refraining from unnecessary trips to urban areas. The income that Village Phone Operators derive from the Village Phone is about 24 percent of the household income on average – in some cases it was as high as 40 percent of the household income.

The increase in household income meant improved food security, a greater ability to invest in health, education, and clothes for children, and in an increased propensity to save.

The lessons from this program are now being applied in Uganda, where an initiative is underway to provide rural communities with communication services to enable them to break out of the cycle of poverty. Agreement was reached between the Grameen Foundation USA, MTN Uganda (the country's leading mobile telecommunications provider) and its public access partnership, together with a number of microfinance organizations. From the successful pilot program in 2003, an independent company, MTN VillagePhone was formally created and has been successfully extending its operations.

Lessons that are emerging include: all parties should benefit; microfinance sector is a channel to market; the telecommunications provider should provide wholesale airtime to VillagePhone operators; and in-country staff should manage the business.
Source: 1 Grameen Telecom's Village Phone Programme in Rural Bangladesh: a Multi Media Case Study. Canadian International Development Agency, March 2000. Keogh and Wood, 2005

3.3.4 Increasing interaction, participation, and amplifying "voices"

ICTs are being seen as presenting new opportunities for the voices of those who are not usually consulted ─ particularly those who are affected by ill health ─ to be heard, and for that local knowledge to be used to help frame and develop better services and better responses to people's illness.

Ownership of communication
Most of the studies highlighted in this paper are owned primarily by experts, rather than the beneficiary communities. They rarely suggest any consideration from stakeholders about

what they think of the studies and whether they reflect their needs. ICTs present new innovative ways for the local voice to be amplified.

New opportunities
ICT has resulted in innovative and new communication forms. There is more peer-to-peer communication between individuals, as well as between intermediaries such as the media or health workers. There is more scope for personal reflective communication, anonymous online communication and research and online community networking by communities of interest as well as the traditional communities as defined by geography or social character. For example HIV and AIDS provides many illustrative examples of new communication enabled by ICTs; e-forums and news groups abound, as do Websites by both health service providers and health communicators, advocates, international and local groups, and many others.

Increased two-way communication via radio
Increasingly, program planners are being advised to make use of application designs that encourage long-term interactive dialogue, rather than one-time broadcast of information (Maxfield, 2004) and approaches that make use of more than one particular technology. Radio remains a central medium for health education, health promotion, and participatory health communication in developing countries. A major future trend is the convergence of radio with Internet-based communications.

Newer ICTs add to radio the potential to develop a stronger feedback loop, with listeners engaging with the broadcasters in a range of innovative ways, such as through increased phone-ins due to mobile telephony, through e-mail and other Internet based communication. Case studies of interactive radio instruction (IRI) in the Dominican Republic, Zambia, and Guinea show that this use of a previously one-way technology can effectively reach hard-to-reach populations and result in high-learning gains and decreased inequality (Bosch 2002).

Increased local expression about health can include people talking about health issues on the radio via mobiles or via submitting e-mails. ICTs present opportunities for expressing opinions, networking locally and globally about health advocacy issues, and opportunities for personal expression via blogs, e-mail, chat rooms and e-forums. While many aspects of ICT impact are still strongly western in nature, this aspect of personal and community expression is gaining ground in the developing world, where Internet cafes and mobile telephony present opportunities for improved access, and where the ICT-enabled communication is not predicated on expensive equipment, knowledge, or social position. There is a democratizing aspect of the open unmediated communication that ICTs offer. There is a growing body of anecdotal examples of audience engagement via radio. Internet, e-mail and mobile telephones do provide compelling evidence that ICTs are certainly increasing the opportunities for such expression. Whether this translates to impact on policy or social structures is another debate.

3.3.5 Key lessons

These are some of the key lessons about the role and potential of ICTs in improving communication in health care:

- There is growing evidence that ICTs aid health information dissemination, particularly via online routes.
- There is growing evidence that ICTs increase the effectiveness of some communication systems.
- Increasing access to communications allows more people to be linked to communication opportunities.
- Mass media ICTs, such as radio, remain key in communicating health issues.

- There are demonstrable benefits in combining technologies, particularly some of the older with some of the newer ICTs.

4. Constraints and challenges

A number of factors can inhibit the introduction and successful application of ICTs in the health sector in developing countries. Satellife (2005) identified three main factors: **connectivity**, **content** and **capacity**. Madanmohan Rao (2005) adds five more factors for analysis: **community**, **commerce**, **culture**, **cooperation,** and **capital**.

4.1 Connectivity

With connectivity, there are issues such as the lack of an enabling telecom policy and regulatory environment; lack of access to electricity, solar power options, and power supply back-ups; insufficient infrastructure and connectivity access; and high costs. Embedded in this are issues of broadcasting rights and regulations controlling the media.

Connectivity access – measured in terms of telephone access, personal computer ownership, and Internet connectivity – varies widely around the world, as indicated in Table 3. Inequitable access also exists within societies. Within developing countries, segments of the population have been by-passed by the products of the information revolution. This is complicated by the fast-changing deployment of new technologies and accompanying standards that constantly raise the level of advancement that must be met by anyone who wants to remain current (Ishaq, 2001; Alcántara, 2001). This is part of a set of much broader constraints that include insufficient telecommunications infrastructure, high telecommunications tariffs, inappropriate or weak policies, organizational inefficiency, lack of locally created content, and uneven ability to derive economic and social benefits from information-intensive activities (DOT Force, 2001; ECLAC 2000; Chandrasekhar and Ghosh, 2001).

Table 3: Connectivity access 2004

Countries	Main Telephone Lines per 100 Persons	Personal Computers per 100 Persons	Internet Users per 100 Persons	Internet Hosts per 10,000 Persons
WORLD	19.0	12.9	13.6	422.2
Africa	3.1	1.7	2.6	4.9
Americas	33.9	34.5	30.9	2347.6
Asia	14.3	6.35	8.1	74.3
Europe	40.9	28.5	31.1	362.6
Oceania	43.4	50.7	47.9	1408.3

Source: International Telecommunication Union, World Telecom Indicators 2004

In the health sector, development and digital divides between industrialized and developing countries are wider than the gaps observed in other productive and social sectors. In some cases, the changes brought about by the privatization of health care added to the already high degree of structural inequity that prevails in most low and middle-income countries.

Dependable connectivity is needed for reliable transactions. In developing countries reliable broadband connectivity is still limited, and usually only dial-up access is available. Poor telecommunications infrastructure, limited number of Internet Service Providers (ISP), lack of access to international bandwidth, and high Internet access costs continue to be barriers to

widespread use of ICTs. National expenditures among countries, even for countries of comparable income level, vary considerably (Casas, 2001). Low per capita expenditure in health limits the market for new and expensive technologies.

Per capita expenditure in ICT is a better indicator of the real level of ICT investment than expenditure as percentage of the GDP. Some developing countries have expenditures that are comparable to that of developed countries when expressed as percentage of the GDP, although the absolute value per capita is low. For instance, relative to GNP, Brazil has the same level of expenditures as Canada, although in absolute value Brazil invests 6.6 times less than Canada in ICT (World Bank, 2002).

4.2 Content

Content factors include the lack of local content creation, the language used and the relevance of content to the local situation. Appropriate language is frequently neglected in ICT programs and little content is available in local languages for health programs.

Another major content issue is the quality and reliability of health information. The Internet can provide a wide range of users with timely, accurate, diverse, and detailed health information. However, its decentralized structure, global reach, levelling of access to the tools of publication, immediacy of response, and ability to facilitate free-ranging interchange also make the Internet a channel for potential misinformation, concealed bias, covert self-dealing, and evasion of legitimate regulation. It is very difficult to ascertain and recommend the credibility, motives, sponsorship, and eventual conflicts of interest in the more than 50,000 health Websites in existence. Many health public-oriented Websites are profit-driven, others promote unproven and even dangerous forms of treatment or products, while others may have good intentions, but contain misleading or false information (Rodrigues, 2000c; CHCF, 2000, 2001; Berland, 2001; Risk and Dzenowagis, 2001).

Given the sensitive nature of health care information, and the high degree of dependence of health professionals on trustworthy records, the issues of reliability (assuring that data residing in the electronic health records are accurate and remain accurate), security (owner and users of the electronic health records can control data transmission and storage), and privacy (subject of data can control their use and dissemination) are of particular significance and must be clearly and effectively addressed by health and health-related organizations and professionals (Ramsaroop, et al. 2003).

Reliability, security, and privacy are accomplished by implementing a number of preventive and protective policies, tools, and actions that address physical protection, data integrity, access to information resources, and protection against unauthorized disclosure of information. A comprehensive review and reference source on personal data protection regulation was published by the Pan American Health Organization (Rodrigues, Wilson and Schanz, 2001).

The experience of supporting the development of appropriate health information in East and Southern Africa (see Example 11) illustrates a number of issues concerning the development of effective and relevant content. It makes the point that creating and sharing local content is a huge responsibility and increasingly demanding and complex. To achieve results, more investment is needed in terms of time, facilities, staff, and training. More support and stronger commitment are required from governments and donors. This particular approach made use of existing national information centers and tried to strengthen them through building capacity and introducing a more effective collection of information processes and searchable electronic databases. The most active centers had technical people who championed the activities of the center and provided leadership, vision, motivation, support

and guidance. However, it takes longer to achieve results when adding work to an existing center that already has a full complement of activities.

Example 11: Health Information Dissemination Centers in East and Southern Africa

Promotion of health policy and programmatic changes requires access to current research findings, prepared in formats that are easy to use. A project to strengthen the capacity of institutions in East and Southern Africa to collect, collate, and distribute relevant health and nutrition information in a timely manner and increase information access at the policy and program levels was undertaken by the Commonwealth Regional Health Community Secretariat (CRHCS) and the Support for Analysis and Research in Africa (SARA) project. A joint CRHCS/SARA assessment identified existing institutions to serve as information dissemination centers (IDCs).The role of these country IDCs was to disseminate regional information, collect country-specific information and grey literature, and conduct greater outreach to ensure that policymakers and program managers had access to the information. Dissemination center coordinators gathered existing research from institutions around the country on reproductive health and nutrition. Most centers collected research studies and wrote annotations that were produced as annotated bibliographies. In some areas, these were stored on searchable databases. As research was identified that could have wide impact – a study on the consequences of unsafe abortion was one example – computer-mediated presentations were developed together with short and targeted printed summaries to share findings at regional, national, and district level workshops and conferences. In Zimbabwe, a local theater company developed a play about the findings to share with a number of different audiences.

Key lessons from the experience include: information needs to be in the appropriate format to be valuable and used by various audiences; a greater variety of formats and channels used to share the information makes it more likely that the information will be be used; content and information experts need to collaborate to determine the key target audiences, and the best formats and delivery channels to reach these audiences, and share the information in as many different ways as possible.
Adapted from a case study by Renuka Bery in Balantyne, 2002

The greatest challenge facing any dissemination activity is the need to repackage information differently for various audiences. These skills are critical, yet scarce. Moreover, repackaging information takes valuable resources that are often unavailable. Content experts or a team of experts are required to identify what research needs to be repackaged. Often, both technical content experts and information and communication specialists need to be trained to repackage material, work together to build a strong evidence base and help to make the information more accessible to policymakers, health workers, and the public.

4.3 Capacity

While capacity to adapt information to ensure that it is culturally appropriate and relevant is a major challenge, so too is the capacity to use ICTs effectively, and to service and maintain them. A skilled ICT work force is an essential ingredient for the effective use of ICTs in health. Systems professionals and technology products and services providers and project team leaders with high skill levels and experience in working in the sector introducing the ICTs are important components of success. The number of technicians, scientists, and portion of the GNP devoted to research and development is a good indicator of those capabilities. Although the statistics in Table 4 are now a little dated, the trend and pattern they indicate demonstrate the regional variances in capacity, something that still needs to be addressed in today's society.

The most successful efforts to incorporate information and communication technologies have occurred in countries with strong and efficient government and academic institutions committed to investing in education, scientific and technological development, and public services, in tandem with business sectors (for instance, banking and retail commerce) ready and willing to automate their operations.

Capacity also refers to inequities in societies and the sharing of resources within the community. For example, due to lower rates of literacy, women (and marginalized groups in general) are not given equal access to the benefits of ICTs.

Ensuring that women are part of the target group, that gender deliberations have been undertaken by choice of the ICT tool, and that language or cultural norms do not exclude women benefiting from the ICT intervention are important considerations (Danida, 2005). Several recent reports have provided highlights of the use of ICT to combat HIV and AIDS. In November 2001, a consultant for the International Development Research Council produced a comprehensive report showcasing several pilot project activities in this area (Driscoll, 2001). Among other conclusions, the author recommended the importance of teaching girls and young women how to use the Internet. Other evidence (Mar Gadio, 2001) also suggests that women with the mastery of almost any level of ICTs increase their self-esteem and has spillover effects into other activities that work toward poverty alleviation, an important element in decreasing their susceptibility to economic situations that put them at greater risk of catching HIV and AIDS. The Mangelete women's group in Kibwezi, which started the first community radio in Kenya, for example, has trained rural women in the production and use of video to generate income, disseminate new skills, and use the Internet to access the necessary information (Anon, 2002).

4.4 Community

The question to be addressed here is who is using ICTs? What are the communities of users and what services exist to facilitate use and to encourage those who have not been previously involved in health dialogues?

An important approach to the design and implementation of any ICT and health program is to identify the various stakeholders who need to be involved and find mechanisms for including their perspectives and concerns and to find ways to mobilize their skills, expertise, and resources.

4.5 Commerce

New technologies have made it possible to open up trade in medicines and services via the Internet. This has both positive and negative consequences. One of the key factors to consider here is the degree to which it is possible to develop effective national or domestic Internet economies that promote online transactional capabilities that will be beneficial for consumers, businesses and public health interests.

4.6 Culture

Cultural issues need to be addressed in terms of appropriate and relevant content. Another aspect of culture is the need to examine and challenge the cultural inhibitions and barriers within society and institutions that prevent effective use of ICTs. This includes a commitment to transform the rules and regulations on telecommunication and broadcast systems. It also means increasing political will to ensure that government procedures are more transparent and that information-sharing cultures are encouraged.

4.7 Cooperation

The use of ICTs for health and development involves local, regional, and international participants as stakeholders. No one sector or one set of stakeholders can deal with the complexity involved in the effective use of ICTs in health. Technical knowledge, experience, and financial investments needed to establish large and complex ICT initiatives require tapping into resources and expertise that no single organization retains. Several key groups should be considered when discussing efforts for ICTs and health. Dzenowagis (2005) identifies six major groups:

- Citizens (including patients)
- Professionals
- Hospitals and academia

- Health-related businesses
- Governments
- International agencies

Each of these could be broken down further. For example, the OECD (2005) has catalogued the activities of the major international agencies with an interest in ICT programs for development. Within each grouping, there may also be those with a health focus, those with a technology focus, or those who are most concerned with development issues. They often have different perspectives on the aims and objectives of introducing ICT into healthcare and hold different views on potential barriers to implementation.

The successful implementation of ICT and health programs requires complex balancing of the competing views and concerns of the different stakeholders. Some clinicians will view new technology with suspicion, fearing its challenge to their professional autonomy and status. Patients will often seize on the potential benefits (particularly in making care accessible where care would otherwise not be available) but will also hold legitimate concerns about the security and confidentiality of any electronically held patient data. Information technology specialists may seek to use cutting edge technology where existing tried and tested technology would be more than adequate to deliver real improvements in patient care. Policymakers may need to be convinced that the initial investment costs in the new technology will bring the benefits promised. All these differing views and concerns need to be addressed at the outset of any intervention involving ICTs.

Successful stakeholder engagement is not easy. People with the greatest health needs are often those that prove to be the most difficult to engage. If new technology is to meet their health needs, then carefully developed engagement strategies need to be developed. Crucially engagement needs to start at the beginning of an intervention; otherwise there is a risk of developing technical solutions looking for a problem to solve. Health needs and the views of the communities to be served must drive ICT initiatives.

Effective participation of a large number of stakeholders needs to be coordinated by the public sector. So too does the development of policy frameworks to guide the use of ICTs. Absence of a national policy framework for ICTs and health is a further challenge and obstacle to achieving the successful introduction of ICTs into health programs (WHO, 2004). Even where policies and strategies exist, technology developers, suppliers, users, and decision-makers must be aware of them and the effect they may have on their judgment regarding the acquisition, development, deployment, and operation of health ICTs. Policies must, necessarily, be in consonance with any overall informatics policies in force in a country as well as with its overall health sector policies. The national health ICT policies, in turn, set limits to any policies that may be established lower in the hierarchy, at regional or local levels. Once formulated, they must be implemented in a coordinated manner. The goal of establishing national strategies for ICTs is to provide a coherent national arrangement directed to facilitating projects, infrastructure development, maximizing the benefits for invested financial resources, and enabling people to function more effectively.

Successful engagement with health workers is also crucial to the integration of ICTs in healthcare. ICT can be very challenging to the autonomy and professional status of health workers. The challenge arises from the ability of ICT to fundamentally change the way care is delivered, changing working practices, enabling different skill mixes in clinical teams, empowering different clinicians to make decisions about patient care, and empowering patients to self care.

Clarifying the distinct roles for different stakeholders is important in ensuring that their efforts are complementary (Panos, 2005). For example, the international donor community plays a

role in coordinating funding of ICT and health programs. National governments should focus on establishing a clear regulatory framework, promoting equal participation of stakeholders, and coordinating implementation. Civil society organizations, the private sector, academic institutions, and health system institutions are likely to lead on implementation and in monitoring, evaluating, and learning from experience. Grassroots organizations and local governments have roles to play in identifying needs.

4.8 Capital

Generally, there is little investment in ICTs for health in most developing countries. The picture is one of fragmentation, with many different varieties of ICTs being acquired from different donors. Very few government-run health services have properly functioning ICTs within them, and there is no reliable infrastructure to enable inter-organizational transfers of information. Invariably, there is no national health information and IT infrastructure to underpin the delivery of health care. WHO (2004) makes the point that technologies must be "integrated into health services that meet basic needs" if they are to be considered to be essential investments.

In East Asia for example, investment in ICTs for health is less advanced than might be expected, due to institutional, cultural, and financial factors (Holiday and Tam, 2004). The financial factor is one that is common to other regions: effective use of ICTs in health will need funding at a higher level than is currently the case. Finding ways to blend private and public resources in ways that contribute to the development of improved, publicly accessible knowledge bases are key challenges.

The only justification for using a particular ICT intervention is that the benefits justify the costs (PAHO, 1999). Those benefits must be identified, not only in monetary terms but also in terms of improvements in access, quality of care, better return of resource utilization, better clinical end results, user satisfaction, and improvement of the overall community health status. Given the limited and finite resources available to health decisionmakers, the right choices can be reached only by appraising the alternative options to see which carries most added value, and is affordable and within budgets.

Unfounded vendor-driven expectations of how the Internet will revolutionize health care have too often overshot their targets (Price Waterhouse Coopers, 2000). Overestimation of results and consequent unfounded expectations are common pitfalls. A common error has been to regard technology as the solution to logistical, administrative, and knowledge management problems of healthcare. The lesson to be learned for the use of ICTs in health is that technology can be justified economically only if organizations deploy it in a real practice environment and closely track how managers and direct care professionals are using it. This requires the stepwise development and implementation of processes and metrics to monitor productivity and impact (Hagland, 2001; Yaffe, 2001).

When investing in ICTs, a number of key criteria for evaluating and approving the project must be considered. Investments in ICTs are no different to other significant investments in terms of the procedures that must be followed and the need for rigorously constructed business plans (PAHO, 1998). These are some of the types of questions that could help:

- Is the investment consistent with the ICT strategy of the country or institution?
- Will the investment support the broader goals and objectives of the implementing body?
- Is there a realistic business plan?
- Have the benefits been assessed and has a commitment to achieving those benefits been obtained from those most affected by the change?

- Has consideration been given to achieving those benefits through another route? (What happens if there is no investment? Can current practices be modified to achieve the same change? Are ICTs necessary to achieve the change?)
- Has a risk assessment been done?
- Is there a clear understanding of the procurement process?
- Has a project manager been identified and is there a robust and structured system for implementing the plan?
- Is there a commitment from senior managers to implement and provide leadership?
- Are there sufficient technical skills?
- Have sufficient resources been devoted to training and capacity development?
- Is there a clear monitoring and evaluation process in place?

Part of the cost-benefit analysis includes the question of sustainability. Interventions need to be designed that will have an impact not only in the immediate future but for many years to come. Sustainability issues can include ongoing upgrades, training, and maintenance of the system.

ICT projects, particularly those dealing with information systems, are notorious for running over time and over budget, yet often still failing to deliver all the specified functions in a satisfactory manner. This can be largely avoided by effective project management, including planning, quality assurance, and resource management components. Obtaining an effective system is not simply a process of competitive tendering, local development, or acceptance of an externally funded donated system. The procurement process should be planned and structured, in order to match the solution to the need and circumstances. This in turn needs a systematic approach to defining the requirements and the available resources, including running costs and staff availability.

5. Emerging trends and potential impact of ICTs

Predicting the future in the ICT sector is a hazardous occupation. As the Inter-American Development Bank (IDB, 2005) notes, the rate of technological innovation accelerates technological obsolescence. Technologies are changing rapidly and so too are opportunities. Nonetheless, some broad predictions are possible.

5.1 Emerging trends

Five areas of technology likely to offer strong potential for new developments are:

- wireless access to the Internet;
- wider use of telephones, particularly mobile telephony;
- greater exploitation of the power and reach of radio, and the ability of radio content to be locally determined;
- the use of digital video techniques to enable local language communication tools; and
- greater focus on combinations of technologies.

5.1.1 Wireless access

Wireless Internet has the potential to provide low-cost broadband Internet connectivity to underserved and remote areas. Leapfrogging the delivery of a wired infrastructure by moving to wireless or radio technologies is also attractive to developing countries (Wireless Internet Institute, 2003). Wireless technologies may be deployed rapidly to help foster economic development and workforce productivity and to enable delivery of applications in the areas of e-health, e-education, and e-government. Example12 demonstrates how such an approach is beginning to transform life in rural Indian villages.

Example 12: Wireless Internet access in rural India

In Tamil Nadu state in India, the Sustainable Access in Rural India (SARI) program has provided wireless Internet connections to some 8000 people in more than 50 villages. This involved public, private, and academic collaboration and helped set up local service providers operating local telecenter kiosks for little more than an initial $1,000 investment. Among the applications of the kiosks is a partnership with the Aravind Eye Hospital to provide online eye consultations. Kiosk operators are trained to take pictures of eyes and e-mail them to hospital doctors. Based on these images, doctors can make a preliminary diagnosis and recommend various courses of action: make an appointment, try a home remedy, visit a local eye clinic, undergo an operation. Some 80 patients used the service during a six-month period. The lessons from the SARI project have been shared and the experience replicated in 7 other Indian states, through another 16 projects. The aim is to cover some 500,000 villages over a period of five years, thus providing access to some 85 percent of India's rural population.

Source: Wireless Internet Institute, 2003

5.1.2 Telephony

A recent study (Micevska, 2005) has identified a strong connection between the use of the **telephone** and an increased demand for health services in Bangladesh, Peru, and Laos. The analysis at the household level shows that basic telephone service offers opportunities in delivering timely information on health services to households with relatively greater demand for this type of information.

Health workers will be able to track and monitor patients' symptoms using **mobile phones** with text capabilities in conjunction with a central database. For example, visiting nurses in the field might ask people living with HIV or people with TB a series of yes/no questions about their status, symptoms, and reactions to particular medications. They can also assess

the need for more medication in a particular area. This yes/no information can be entered into a mobile phone and sent to a central database. By creating an up-to-date database of health information, health workers can track infectious diseases in remote areas, coordinate medical supplies, and make better decisions based on more accurate information. In Egypt, mobile phones have been used to promote maternal and child health. Home delivery was discussed by mobile phone users in rural areas and the phones used to mobilize assistance or transport to qualified health workers if deliveries proved problematic (Anon, 2005).

Example 13 describes how mobile phones are being used in South Africa by 80 counsellors to support people living with HIV to follow the treatment plan for their anti-retroviral drugs and how text messages are helping TB patients remember to take their drugs.

Example 13: Mobile phones keep track of HIV and TB treatments

South African researchers have developed novel applications for mobile phone technology that improves adherence to HIV and TB treatments. These approaches have obvious benefits for the patients as well as helping to improve the health infrastructure and monitoring systems.

The Cell-Life project, backed by local mobile phone giant Vodacom, has developed software and data management systems that let clinic workers use their mobile phones to monitor patients' HIV treatment and spot health problems before they become life-threatening. The phones are loaded with R55 (US$8.50) in airtime each month and equipped with a special menu that enables HIV counsellors to record data on a patient's symptoms and whether they are sticking to drug regimes, as well as other factors that might affect their health — such as a lack of money to pay for transport to the clinic, or a shortage of food. The information collected is instantly relayed over Vodacom's network to a central database, which clinic staff can access over a secure Internet connection. Cell-Life has just completed successful pilot projects in townships in Cape Town and Durban, in which about 80 counsellors were trained to use the mobile phones and kept track of nearly 800 patients. There are plans to expand the project's reach into other provinces, and to develop “reverse billing” software that will enable the clinic to be charged instead of the counsellors using the mobile phones. They could then contact clinic staff in an emergency even if they had no airtime left — a measure that could save lives in communities with few fixed-line phones. There is also a plan to bring South Africa's other mobile phone networks, MTN and Cell-C, into the project.

On Cue, a small company in Cape Town formed by Dr David Green, a TB specialist, has developed a system to send text messages to patients via mobile phones, reminding them to take their medication at pre-determined times. It aims to provide an affordable solution to improve patient adherence to treatment and to reduce associated costs for both patients and clinics. The names and phone numbers of patients are entered in a database and every half an hour the On Cue server reads the database and sends personalized messages to selected patients reminding them about their medication. The messages can be sent in one of three languages and in a range of styles to ensure they do not become boring. Of the 138 patients involved in the pilot, there was only one treatment failure. The idea is now being extended to other areas.

Sources: Kahn, 2004 and www.bridges.org

5.1.3 Radio

The most enduring and established of ICTs, radio continues to maintain a central position in developing country health communication. A DFID issues paper (Skuse, 2004) points to the contribution of community, national and international radio to health programs in the developing world and describes it as a strategic tool for human development and poverty reduction.

There is a wealth of experience of radio health initiatives described by Gumucio (2002), or cited on the Communication Initiative Website (www.comminit.com/radio).

“Soul City” is a high-profile health communication program in South Africa that uses radio, TV, and other media. It has built strong monitoring and evaluation processes into its work and is able to demonstrate strong impact in terms of knowledge, awareness, understanding, and change of practice in selected issues it has covered. Commentators rate radio highly as

a cost effective, high penetration medium that offers affordable communication support services to remote, poorly-equipped, and minimally-staffed health facilities and communities. (Davies, et al, 2005).The established nature of the radio medium and its key role in decades of health communication mean that it enjoys an analytical credibility that other, newer ICTs still lack.

The liberalization of broadcasting in many developing countries plays a role in enhancing the position of radio as a powerful health communication route, although conversely commentators such as Skuse (2005) point to this increased density of media, radio, and TV, as a potential danger. “This has critical implications for how health messages are communicated, since there is very real potential for important health messages to be lost in a sea of media. Organizations such as the BBC Service Trust and Massive Effort respond to this by increasing the volume and density of messages in response. So increasingly, increased media complexity may force us to either 'upscale' on mass health promotion campaigns or 'go local' and use community mobilization increasingly to get messages across.”

5.1.4 Digital video

Health workers in villages can now carry VCD and DVD players that can communicate a basic message, which can then be followed through with discussion. In the past, video has been expensive to make and difficult to show in rural areas. Production of a video can now be done on a basic computer, and the cost of making a local language video produced by local health workers is less than a few hundred dollars. Portable digital players can be easily used to show the video. This process is only going to get easier. The NGO Gamos has explored this in Mexico, Moldova, South Africa, Cambodia, and Ghana. Impact studies show a remarkable change in knowledge and behavior based on the videos. In Ghana a number of agencies, including the Health Foundation of Ghana, have now trained their staff and are beginning to develop local language videos that can be shared with each other (Gamos, 2005).

5.1.5 Convergence and combination of technologies

Convergence and combination of technologies can help many developing countries improve patients’ access to medical records and improve access to health information for patients and health workers.

It has long been recognized, as a DFID report in 2001 noted, that “a combination of new ICTs and traditional media can provide the widest coverage and ensure that those excluded from education by virtue of poverty, gender, geographical remoteness or conflict are not excluded” (Skuse, 2001).

Deciding which technologies to use “should be determined mainly by the specific local context and demand” (Weigel and Waldburger, 2004). In Kenya, AfriAfya has been working for more than five years to explore innovative ways of combining ICTs in different field settings, as Example 14 demonstrates. Its experience underlines the importance of undertaking information-needs assessments – finding out what information people want – rather than simply supplying them with what is available. It also was quickly evident that despite the large amount of information available on the Internet, very little is directly suitable for dissemination to poor communities. It needs to be repackaged to ensure local suitability and relevance.

Example 14: AfriAfya – working with a combination of ICTs

The idea for *AfriAfya* - African Network for Health Knowledge Management and Communication - is based on the realization that modern ICTs have done almost nothing for rural communities. It was established in April 2000 by Kenyan-based health and development agencies to explore harnessing modern ICTs for community health among marginalized communities. Working with communities in different parts of the country, a small hub has coordinated a two-way system of information exchange. Through this, AfriAfya has implemented program activities that use a combination of satellite technology; radio; video; print; e-mail; text messages on mobile phones; CD ROMs; telephone; post; folksongs; and traditional media to improve access to health information, with HIV/AIDS as the pathfinder topic. AfriAfya has demonstrated the use of appropriate information and communication technologies (ICTs) to generate, manage, and disseminate information. Some of the activities include

- training change agents in information management skills and application of ICTs to access, produce and share health and other development information;
- establishing community-based resource centres;
- working with communities to respond to information gaps; and
- collecting, repackaging and disseminating health and other development information.

Content is generated from the experience and questions provided by the communities involved. This is augmented by official publications from the MoH, the National AIDS and STDs Control Programme, *AfriAfya* Partner Agencies, other HIV/AIDS organizations in the country, and from the Internet. The information is repackaged by the hub and sent to the field centers for use by frontline health workers and change agents, helping them to deal with health problems and questions raised by lay community members. Questions from the field centers relate to a range of issues:

- Simple factual issues (Can one get AIDS from being bitten by a mosquito? How effective is a condom in preventing HIV transmission?)
- social issues (How can I deal with the unfaithful drunken husband who will not agree to condom use?)
- cultural issues that promote the spread of HIV/AIDS (How can we deal with '*matanga*' - funeral rites that involve a lot of sexual activity thus contributing to spread)
- community experiences gained over time (Is it true that engine oil or specified toothpastes can help to relieve HIV-related skin lesions?).

Source: Adapted from a case study by Caroline Nyamai-Kisai in Ballantyne, 2002

The convergence of new and old technologies is well documented in a report from FAO (Girard, 2003). The report, which presents examples of converging radio and new ICTs for development, argues that radio will have even greater significance and value in years to come. Particularly relevant is the chapter on "Take Five: A handful of essentials for ICTs in development" by Alfonso Gumucio Dagron where he describes a set of "non-negotiable conditions for ICTs in development." These include:

- Community ownership
- Local content
- Appropriate technology
- Language and cultural pertinence
- Convergence and networking.

The advent of wireless Internet access potentially allows the use handheld communication devices, Web-enabled telephones, interactive television, Web and e-mail terminals (Eng, 2001; Primo Braga, 2003; WideRay and Satellife, 2003). The novelty and improved efficiency of new technologies may have the biggest effect on the acceptance of second-generation technologies in youth programs (IPPF/WHR 2001). There is a need to identify or develop methodologies for passing content from one medium to another, for example, from the Internet to community radio. Several organizations are modifying computer technology to make it more appropriate for rural areas; for example, the Simputer is being developed in India for rural low-literate populations (Harvey 2002).

By using online broadcasting, radio stations can increase their range, from local to global, sharing health content and opinion, and enhancing the value of effective health programming by enabling it to be heard more widely. Online health communication resources, such as the

Aids Media Center portal for sharing HIV and AIDS communication news and resources for developing country media (www.aidsmedia.org) help to extend the reach. The mix of radio broadcasting and satellite (for example Worldspace satellite radio) is also another example of how old and new technologies are combining to enhance health communications. Nearly every type of new ICT presents an opportunity for synergy with radio broadcasting for health.

5.1.6 Continual technological development

Advances in digital and compression technologies mean that vast amounts of information can now be stored on smaller and smaller chips. This allows development of up-to-date digital medical libraries and databases, which can be searched online over the Internet, stored on a laptop computer, or on smaller hand-held devices such as a PDA or portable media storage device.

In the near future, health workers in developing countries will be able to access these databases from remote sites. Thus, a rural physician could search a vast online Internet database of medical articles for information describing a rare disease and its possible presentations; or nurses in remote areas could individually access continuing education classes via a desktop computer along with a Web camera; or government officials could conduct HIV and AIDS training and education on a regional level using videoconferencing centers.

Additionally, the introduction of electronic medical records on a more comprehensive basis could provide an effective mechanism for health workers to keep good records on which public health information systems can draw, track, and monitor. The development of good records and accurate data is becoming a critical global issue with the incidence of AIDS, SARS, and other communicable, borderless diseases.

Clear lessons concerning the emergence of new technologies include the advantages of integrating ICT activities into other programs, the benefits and strengths of building on existing systems and structures, and the need to stimulate and foster telecommunication sector reform processes.

ICT projects appear to be more likely to be successful when they are added as enhancements to pre-existing projects with established goals and guidelines for outcomes. According to Johns Hopkins University (Maxfield 2004), ICTs cannot stand alone in most health programs and need to be integrated into them so the strengths of the ICTs complement other approaches. This underlines the need to ask how ICTs will contribute to real enhancements and improvements in the health of people rather than simply promoting connectivity as a good thing.

Building on existing structures is quicker than starting from scratch – working with already established health intervention sites has allowed AfriAfya to jump-start and bypass many of the very time consuming start-up stages.

There are strong indications that impact can be made through encouraging public-private partnerships and enhancing mechanisms for financing such ventures.

5.2 Potential impact on individual behavior and decision making

A crucial question to address when looking at ICTs in health is: What is the potential impact of information and communication on individual behavior, and on individual health decision

making? Examining the question of incentives for individuals to absorb and act upon health information is also a vital area of consideration.

When examining the impact of ICTs on individual behavior and decisionmaking, it is necessary to first look at the impact of the communication itself, not solely the delivery mechanisms for that communication. The positive impact of the ICTs will only be as good as the quality of the communication conveyed. If ICTs enable the generation of new styles and types of communication that address people's needs in new ways, then their impact might be considered to be beneficial.

An example of the potential impact of ICTs on an individual's access to information and increased communication can be seen in various health areas. HIV and AIDS are particularly illustrative, as many Websites, e-forums and e-resources have been developed directed at beneficiaries, which include the general public, people living with HIV/AIDS, health workers, and treatment activists. The table below gives a sample of the variety and density of ICT-enabled tools being produced and accessed.

Table 4: Reproductive health activities benefiting from ICTs

Activity	ICT applications	Examples
Research	• Literature databases • Libraries • Online-collections of PDF documents available through e-mail	• Free medical journals (www.freemedicaljournals.com) • id21health (www.id21.org/health/) • Eldis (www.eldis.org) • PRB e-library (www.prb.org/email) • Population and Health Info Share (www.phishare.org) • RH gateway (www.rhgateway.org/) • African Journals Online (www.ajol.org)
Networking	• Electronic discussion groups • Conference announcements and proceedings • Professional Websites	• Afro-Nets (www.afronets.org/index.php) • Interagency Gender Working Group (www.igwg.org/) moderated listserv (to join, email igwg@prb.org) • WHO's Health Information Forum (HIF-net) e-mail discussion list (to join, e-mail health@inasp.info) • Second Asia Pacific Conference on Reproductive and Sexual Health (www.apcrsh.com/) • The Association of Uganda Women Medical Doctors (www.auwmd.interconnection.org/)
Advocacy	• E-mail discussion lists • Online newsletters • Websites	• Saathii (www.saathii.org) • Microbicides (www.global-campaign.org/resources.htm) • Angel Coalition (www.angelcoalition.org/)
Health worker education and training	• PowerPoint curricula • Blended Web and other technologies • Learning centers • CD-ROMs • E-mailed newsletters, updates • Video conferencing	• Supercourse (www.pitt.edu/) • Virtual campus of Public Health (www.campusvirtualsp.org/eng/index.html) • TALC (www.jhpiego.org/) • EngenderHealth modules (www.engenderhealth.org/) • JHPIEGO TrainerNews® (community.jhpiego.jhu.edu/) • Adapting to Change training (www.reprohealth.org/) • IT*CAN* Information and Communication Technology Capacity Building for Asia Network (www.it-can.org)
Reaching youth	• Blended combinations of radio, video, Websites • Telephone hotline	• Soul City (www.soulcity.org.za/) • HIV/AIDS telephone helpline, Rajasthan, India (www.comminit.com/)
Improving	• Handheld computers for	• Community Access to Sustainable Health (Ca:sh)

health systems	rural health workers to collect data	(http://kaash.sourceforge.net/)
"What's new"	• E-mailed updates on sexual and reproductive health	• Push Journal (www.pushjournal.org/) • The PopReporter (www.infoforhealth.org/popreporter/) • OneWorld.net (www.oneworld.net) • Digital Opportunity Channel (www.digitalopportunity.org)

Source: PATH, http://www.rho.org/html/ict_table1.htm

6. Lessons

Strategies most likely to improve healthcare, livelihoods, and educational quality, as well as advance community economic growth are those that look beyond merely providing access to ICTs. These strategies embrace more holistic approaches, such as fostering *equitable* access, supporting *meaningful* use of ICTs, and encouraging community and user *self-empowerment* through appropriating the use of the technology (Michiels and Van Crowder, 2001).

A number of review studies and analytical papers have attempted to draw key lessons from the many ICT projects undertaken over the years in the health sector and other sectors. Danida (2005) looked at 16 ICT and health projects based in Latin America, Africa, and Asia. Batchelor et al (2003) explored 17 *info*Dev projects. A report for CIDA (Feek, 2003) examined 60 projects from around the world. The International Institute for Communication and Development (IICD) (Ballantyne, 2002) studied some 30 local content examples. Johns Hopkins University (Maxfield, 2004) looked at 22 health communication projects. The FAO (Michiels and Crowder, 2001) explored telecenters. The NGO Practical Action (Talyarkhan, et al 2005) looked at a number of examples dealing with poverty impact. The Swiss Agency for Development and Cooperation (SDC) and the M.S. Swaminathan Research Foundation explored lessons in upscaling pro-poor ICT policies and practices (Gerster and Zimmerman, 2005).

From these studies, 12 key lessons are evident that can be used to guide future work in the use of ICTs in any sector. Table 6 highlights the lessons, and identifies the way such lessons could be used.

Table 5: Lessons and possible actions

Lesson	Possible action
1. Technology is not an end in itself, but a tool to enhance existing work, strengthen existing systems, achieve broader health and development goals, and meet locally determined needs.	Integrate and mainstream the use of ICTs into existing programs and systems.
2. Successful inclusion of ICTs in ongoing health programming depends on the active involvement of beneficiaries and end users.	Undertake stakeholder analysis; encourage stakeholder involvement and participation from the beginning in determining information needs, type of content, and the most appropriate technology to use.
3. Local conditions determine success.	Prioritize locally available and accessible technical solutions.
4. The simplest possible technology solution is likely to be the most appropriate, user friendly and sustainable.	Build on and complement information and communication technologies already being used.
5. No single technology will be suitable for all situations.	Combine old and new ICTs in creative and innovative ways.
6. Capacity development and training components need to be included in all ICT initiatives.	Invest in capacity development – for technological, communication, and content development skills.
7. Developing local and international multi-stakeholder partnerships helps communities become more self-sufficient through capacity enhancement, and by building on existing formal and non-formal communication	Encourage the development of partnerships at local, national, regional, and international levels.

networks.	
8. The enabling environment is crucial to providing information and communication services, innovation and entrepreneurship, and free flow of information.	Ensure the infrastructure required by the technology being used is in place, or in the process of being put in place.
9. Regular monitoring and evaluation of impact generates successful use of ICTs.	Incorporate plans for monitoring, evaluation and impact assessment to ensure critical evaluation of efforts, adaptation, and opportunities to involve beneficiaries and end users in continuous dialogue about progress.
10. Sharing learning and disseminating experience improves practice and understanding of the different ways people learn, communicate, and use information.	Introduce learning processes and frameworks. Develop links with others doing similar ICT interventions.
11, Addressing the needs of the poor and most marginalized, particularly women and girls, is vital.	Consider gender, inclusion, and participation of the most marginalized in all planning.
12. A clear and expressed plan for sustainability ensures that capital replacement and operating costs are identified up front as well as ICT infrastructure requirements and capacity to maintain the program and its impact.	Plan all programs that include ICTs to achieve both-short term and long-term objectives.

This framework paper has also identified a number of key lessons specific to the use of ICTs in the health sector in developing countries. A summary of these key lessons as they relate to intermediaries and beneficiaries, to improving the functioning of health care systems, to improving health care delivery and to improving health communication is provided below. Critical requirements for implementing ICT programs in the health sector are also identified. This is followed by lessons about why health ICT programs fail. There are still major knowledge gaps and some of these are identified. This section concludes with lessons about a possible model for scaling up or expanding successful interventions in the use of ICTs in the health sector.

6.1 Summary of key lessons about the use of ICTs in health

Beneficiaries

- Target beneficiaries need to be clearly identified and their needs clearly mapped at the start of an ICT intervention.
- Beneficiaries need to be involved in the planning, development, and use of the intervention.

Intermediaries

- Intermediaries need capacity to take on the new ICT innovation.
- Without this capacity, the innovation will not translate into an embedded and sustainable benefit.

Improving the functioning of health care systems

- Explicitly identify the objectives and expected results of any information system.
- Engage all participants (from the developers of the system to the users and beneficiaries) to ensure they see the innovation as adding value to existing systems and that they are able to use it, and can see the benefits.
- Information systems must never become static, or they lose their value.

ICTs in health care delivery

- Telemedicine improves resource coordination, strengthens urban/rural linkages and connects remote health staff to centralized health expertise and resources.
- Incorporating already existing technology – such as phone or e-mail – into medical practice and routine consultancies can make a difference.
- There is strong potential for e-learning in health as demonstrated by a variety of successful small projects around the world.
- Multiple ICT routes can, and are, being used for e-learning in a mixed toolbox approach (for example: including Internet, radio, SMS, PDAs in combination with print materials).

Role and potential of ICTs in improving communication around health

- There is growing evidence that ICTs aid health information dissemination, particularly via online routes.
- There is growing evidence that ICTs increase the effectiveness of some communication systems.
- Through the provision of increased communication access, more people are "linked in" to communication opportunities.
- Mass media ICTs, such as radio, remain key aspects in communicating health issues.
- There are demonstrable benefits in combining technologies, particular older with newer ICTs.
- Health information via the media should not be rushed. It is still limited by traditional constraints of communication strategies.

6.2 Critical requirements for successful implementation of health ICTs

These lessons lead to the identification of a number of critical requirements for the successful implementation of ICT projects and programs in the health sector of developing countries. These include identifying:

- purpose, strategies, and scope of services to be provided;
- audiences, customers, and users (targeted populations);
- value of health and healthcare to the individual and community
- current ways to assess individual and collective health problems (community health);
- needs of the individual, community, and nation;
- institutional user needs and commitments; and
- competencies of the organization implementing or hosting the ICT system.

Determining the core objectives, clients, competitors, and competencies in terms of health service provision and information capabilities is an important requirement for introducing ICTs successfully, whether at an organizational or institutional level (a hospital, university medical school, or health center) or at a national level (within the health ministry or across the health system).

This involves examining the following areas:

- Governance – the collection of rules and policies that guide how an institution or health system operates, including its social, economic, political, and legal ownership choices (This also includes looking at structures, processes and skills and competencies).
- Technology governance - the set of policies that control ownership decisions, set rules and standards for, and regulate the use of ICTs.

- ICT strategy – determining which technologies will best meet the purpose, and support the policy objectives.
- Capacity – including project management, information and knowledge management technology, and communication skills to repackage and share information.
- Standards - rules and standards governing the operation of the ICTs must be set so that the technology meets everyone's expectations and delivers what was promised.
- Costs and budgeting – budgets need to cover maintenance of systems, salaries for information staff, and the capital expenditure and operation budgets, as well as training costs.

6.3 Lessons about why health ICT projects fail

There is evidence to show that many ICT projects do not succeed and have little or no sustainability. Richard Heeks (2002) states that one-third of all ICT projects will be complete failures, while over half will be partial failures.

Many reasons can be cited for ICT and health interventions not succeeding. WHO (2004) has identified a number of factors in relation to national programs:

- Lack of proper needs assessment.
- Lack of vision, strategy, and national plans.
- Lack of information and awareness about ICT applications.
- Computer illiteracy.
- Insufficient resources to meet costs.
- Limited experience in medical informatics.
- Weak information and telecommunications infrastructures.
- Absence of legislative, ethical, and constitutional frameworks.

A risk assessment technique has been developed by Manchester University in the United Kingdom to help determine whether an ICT and health project is likely to succeed or fail (see: www.egov4dev.org/ehealthriskdrgap.html). The benefit of such a tool is that it helps to identify the key risk factors in time to be able to respond and mitigate against the risk.

6.4 Lessons about knowledge gaps

Beyond that, there are still questions that need resolution and areas where further investigation can help to extend our understanding and evidence base. The biggest question is **how to move from proof of concept to large-scale implementation?** This needs more research, and more understanding of what makes for effective large-scale approaches. Initial indications are that combining a number of successful, smaller scale approaches that suit diverse local conditions is likely to be more effective than struggling to find a single approach that can work in every situation. This is explored in more detail in Section 6.5.

There are four key questions that need further investigation to broaden understanding and the evidence base of the use of ICTs in the health sector:

- How can we evaluate the impact of the use of ICTs on health?
- What can be done to strengthen the role of and build the capacity of local information intermediaries?
- How can local content that is relevant, appropriate, and practical be developed?
- How can we enable the voices of those most affected by ill health to be heard?

Monitoring and evaluation processes provide valuable learning opportunities to improve program design for future activities, and also to adjust existing programs. Few tools exist to

help program managers and agencies evaluate weaknesses in their ICT and health program design and make mid-stream corrections to their program frameworks. Yet, experience has demonstrated the importance of local improvization and adaptation for program success. Focusing on the development of and use of participatory and simple evaluation tools, methods, and models can make a huge contribution to the learning on the use of ICTs in health. This is an area where further research would be useful to help develop effective tools and processes. Recently, WHO has established a network of centers – the E-health Global Observatory – which will systematically analyze and report on the use of e-health in different countries. This should contribute to the evidence base that can further inform policy and practice (WHO, 2006).

Intermediaries who can transform global information into useful, practical, and relevant knowledge for local people and who can take local knowledge and repackage it for sharing more widely are critical in ensuring the effective use of ICTs in the health sector.

Program designs should consider the role of the intermediary at the same time, if not before, considering the role of the technology. The time and money spent on developing training and capacity-strengthening programs and curricula for various types of intermediaries is at least as important, if not more, than that spent on technological adaptations and modifications.

Because of the significance of intermediaries, policy and program design should increasingly look to identify the position and roles of the intermediaries first and then complement them with appropriate technological solutions. These facilitators of information should be enabled to make adjustments and modifications to designs and implementation strategies, as well as the reassessment of project goals and outcomes.

Increased support is needed for people experiencing and working on health issues to use ICTs to:

- create health content from their experience relevant to their contexts and issues for their neighborhoods, communities, and countries;
- tell their stories;
- communicate the lessons from their experiences; and
- support each other with their health actions (Feek, 2003).

Related to this is the need to train and foster more **local content** generators. Human capacity building is required in both hard skills (like networking) and in human communication skills like marketing, journalism, research, and leadership. These combinations of skills will result in individuals who are well equipped to both transform the information on the Internet and to contribute to that larger pool of knowledge.

The people who use health care services are part of the solution. Too little priority has been placed on the use of ICTs to increase the **voice** of people directly affected or threatened by health issues in policy development, program review, critical thinking and program management roles. ICTs lend themselves to pushing information to intended beneficiaries (Feek, 2003). Much less work has been done to enable those most affected by ill health to share their knowledge, understanding, experience, and ideas for change.

Johns Hopkins University (Maxfield, 2004) predicts that ICTs will make additional demands on health communicators. The interactivity of the technology will demand practitioners with skills and competencies more in line with counselling, conflict resolution, and mediation and other dialogic skills rather than advertising or marketing. This is an area where much more work needs to be done to develop effective tools and processes, and more investment needs to be made in building capacity.

This means a move from the use of ICTs to enable uni-directional message delivery and towards increasing dialogue and interaction among those who are directly affected by poverty and ill health, health workers, and policymakers.

6.5 Lessons about staged development

Developing successful health programs that make effective use of ICTs means paying attention to the lessons learned from past experience. A key lesson is that there is no single technology, approach, or intervention that will work everywhere. The policy decisions on what to scale up in a particular country depend on the local circumstances. A careful review of the use of ICTs in a number of African countries carried out by the SCAN-ICT project found in Mozambique, for example, that small-scale approaches were likely to be more effective than mega-projects and would have "a bigger impact on community development" (Eduardo Mondlane University 2002). Also, the local/national telecommunication infrastructure plays a key role in what choices can be made.

Johns Hopkins University (Maxfield, 2004) says decisions about the use of ICTs in health programs should be made at the country level. The World Bank (2003) suggests that the challenges and the solutions to them will vary not just from country to country, but from city to city and community to community. This underpins the critical approach of ensuring that a situational and needs analysis is part of the planning for the use of ICTs.

The local situation is key to determining which approach is likely to be most effective. The use of needs assessments to clarify local situations is a prerequisite for an effective program. Also, as the experience of AfriAfya in Kenya (see Example 14) found, networking, collaboration, and ongoing partnership between different health organizations and institutions can be successfully developed.

6.5.1 A context-specific approach

The starting point for most ICT interventions has tended to be at the high end of the technology, when the reality is that people need to begin with what is available in their particular setting. Considering the evidence and the lessons about ICTs in health in the developing country context, a new framework to analyze the impact of ICTs on health could be very timely in developing new strategies. There is considerable evidence of positive impact of ICTs in health in the Western context. However this is predicated on capacity, resources, institutional support, and many other enabling factors. It is, therefore, not difficult to assess ICT potential in this context.

When transferred to developing country contexts, these enabling factors are often compromised and/or missing, and this reality needs to be taken on board by all policymakers considering ICT interventions and scale-ups. Small scale is the only possibility in many places because the basic health infrastructure is not in place; the political will is lacking; the money is not available and may never be in our lifetime. A way forward could be to look at a step change framework rather than trying to introduce a predefined system.

Policymakers should therefore consider the use of ICTs in health as a process that needs to be firmly established, with locally appropriate and sustainable foundations, before the rest of the structure or system is developed. In a step-change framework, a starting point would be examining and analyzing what exists at a local level. Each level would be determined by assessing the context. It would move gradually or swiftly depending on enabling factors to more advanced levels of application that go beyond the local and small scale and move into larger scale-up.

The learning from small-scale successes should be applied and the successes replicated in other locations on the same level. The shift from a basic level to an advanced level in a large scale-up might not be advisable as the enabling factors may not be in evidence. Only when they are clearly established and when they are comparable should large scale-ups be contemplated.

6.5.2 A step change framework

A step change framework for developing ICTs in health in developing countries takes account of the level of the intervention, the necessary enabling factors, the evidence and learning that are achieved, and the learning that this feeds into scale-up potential.

With the knowledge that the application of ICT strategies in the developing world context is contingent on a minimum of enabling conditions being in place, it is then a question of decisionmaking about strategic directions. Options include developing more small-scale interventions in locations where enabling factors are in evidence, and developing shared learning about effective interventions and then applying this in a range of new situations.

The scale of ICT interventions and initiatives needs to be understood, because there is no one-size-fits-all. There are graduations of projects, engagement, and development. Once these aspects have been explored it is then possible to outline the scale-up potential.

The following is an example of a step change table

ICT project levels	Enabling factors	Evidence/learning	Scale up potential
Basic Level	local knowledge of how to use appropriate technology	adaptation of technologies to fit local context; new skills developed	new users of basic technology can be trainers for local users and can have skills enhanced
Medium Level	reasonable literacy and numeracy levels; low cost access to appropriate technology; higher level support accessible	benefits of new access to information clearly evident; increased dialogue about health issues leads to increased demand for facilities, services and technology	intermediaries available to introduce and support technology and to adapt and modify content
High Level	regular connectivity; low cost access to technology; strong capacity	systems driven by needs assessment and appropriateness of approach, rather than technology	likelihood of large number of acceptors and users

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7. Conclusions

The scope of this study has been finite and modest, and it is hoped that the knowledge gaps and other identified areas of focus highlighted in this paper will be further researched to build a strong body of evidence and analysis about ICT and health.

It is also clear that even at this early stage in the evolution of ICTs, there is a developing body of evidence, primarily in the western context, which points to a range of benefits and efficiency savings for individuals and institutions in health. This body of evidence is not easily transposed onto developing country context, and the range of contextual issues around the world mean that ready-fit, ”one-size-fits-all” conclusions are difficult and dangerous to make. However the range of benefits that are being highlighted in various small-scale case studies are building a base of tentative evidence in the developing world for the application of ICT strategies. These provide a compelling indication that there are benefits in ICT implementation in health, but that they need to be understood in context and scaled up carefully.

Seven broad conclusions can be drawn about the use of ICTs in the health sector. These seven should be applicable at all levels, and although they are expressed simply here, the complexity of putting them into practice is one of the biggest challenges we face in ensuring that the health system benefits, that health workers benefits, and that the people who make use of the health system – the patients and citizens – benefit and their health improves.

1. Keep the technology simple, relevant and local.
2. Build on what is there (and being used).
3. Involve users in the design (by demonstrating benefit).
4. Strengthen capacity to use, work with and develop effective ICTs.
5. Introduce greater monitoring and evaluation, particularly participatory approaches.
6. Include communication strategies in the design of ICT projects.
7. Continue to research and share learning about what works, and what fails.

8. References

This framework paper draws extensively on a thorough literature review and on-line fully searchable database that was developed as part of the research. In total, more than 2000 materials were identified and assessed. The full database contains more than 400 key materials and is accessible at www.asksource.info/res_library/ict.htm together with an annotated bibliography.

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Appendix 1: Body of Evidence

Major Reviews of the Evidence Base for the Use of Information and Communications Technologies for Delivery of Healthcare services

Review Topics/ reference	Comments
ICTs in Health Evaluation Trends Amenworth and De Keiser (2005)	Review of literature from 1982 – 2002, showing the number of lab studies and technology evaluations declined with more emphasis on the influence of IT on quality of care process or patient care, interpreted as maturation of evaluation research in the field
Remote Interpretation Azarmina and Wallace (2005)	Systematic review identifying nine articles with only one randomized control trial (RCT) of using telephone or videoconference for language and communication interpretation purposes; results suggest remote interpretation is acceptable and accurate, but with higher associated costs
Electronic Communication with patients Balas et al (1997)	This systematic review looked at 80 RCTs of computerized communication, telephone follow up, counselling, telephone reminders, interactive telephone systems, after-hours telephone access and telephone screening. Electronic communications with patients were seen to both improve access and support the coordination of clinical activities.
Patient satisfaction Williams et al (2001)	Systematic review of 93 studies, demonstrating levels of 80-100 percent satisfaction with telehealth care but pointing out major methodological problems in the studies to date (e.g. 2/3 failing to compare with face-to-face standard, half of studies using only 1-2 satisfaction measures)
Socioeconomic Impact Jennett et al (2003)	Systematic review of 4646 citations, analysing 306 sources, finding overall increased access to health services, cost effectiveness, enhanced educational opportunities, improved health outcomes, quality of care and social support by the use of telehealth applications
Systems and services evaluation Taylor (2005)	Systematic review of the evaluation of telemedicine services, concluding that it offers a safe alternative to conventional care but that evidence is lacking that it is cost effective and practical if systems and service delivery are lacking.
Clinical Outcomes Heinzelmann et al (2005)	Systematic review of diagnosis, clinical management and clinical outcomes breaking the results into subspecialty uses. Only 1/3 of studies investigating clinical management or outcomes were based on RCTs with 1/3 of RCTs having less than 30 patients.
Comparison of conventional and telemedicine service delivery studies Hailey et al (2002)	44 studies (67percent) had potential to influence policy; 37 studies showed defined advantages over conventional care delivery services, 13 showed both advantages and disadvantages of telecare, 11 studies unclear about advantages, 5 studies showed alternative approach had advantages over telemedicine; scarcity of quality RCTs emphasised; includes assessment of and updates the two previous systematic reviews by the International Network of Agencies for Health Technology Assessment (INAHTA)
Efficacy of Diagnostic and Management Decisions Hersh et al (2002)	Office/ hospital based, store and forward, and home based services reviewed 59 articles met inclusion criteria. Use for history and physical examination showed good sensitivity and specificity; good efficacy shown for cardiology and ophthalmology; limited quality of evidence for generalised use in management decisions
Telecardiology Bonacina et al (2005)	The review identified the lack of long term studies with only 21 studies reporting project duration of longer than 1 year. Most studies

	were pilot projects with only short term outcomes
Increasing access to primary care in underserved populations Chapman et al (2004)	Although evidence was insufficient to made clear recommendations, this review suggests that walk-in centres and NHS Direct have provided additional access to primary care for white middle class patients rather than to underserved populations, and that these innovations may actually have increased access inequalities
Remote vs face-to-face clinical care Currell et al (2000)	Systematic review showing little evidence of clinical benefits although none of the studies showed a detrimental effect of the telemedicine intervention. Suggests that policy makers should be cautious about recommending increased use and investment in unevaluated technologies
Dermatology Demiris et al (2004)	A systematic review of patient satisfaction with telemedicine applications in dermatology. Fourteen studies identified five regarding store and forward applications with the rest video based interventions. This systematic review demonstrates how methodological weaknesses in the research limit the ability to generalise results. One conclusion was that different telemedicine applications need different satisfaction instruments.
Tele-surgery Eadie et al (2003)	Systematic review giving overview of telemedicine in surgery – including outcomes of studies. Telementoring and teleconferencing have been widely used in surgical training. Telesurgery systems are available and trials have been undertaken in coronary artery bypass, prostatectomy, gastroplasty and cholecystectomy. Outcomes were successful but with prolonged operating times. Improvements are needed in tactile feedback, instrumentation, telecommunication speed and availability. Associated issues of legislation, cost and benefit require clarification
Patient-clinician e-mail communication Eisenbach (2000)	A systematic review looking at email communication, between patient and clinician. The review seeks to provide a set of guiding ethical principles applicable to these communications. It distinguishes between different media and their appropriateness: email is fine for giving health information while diagnosis and treatment require more advanced telemedical technology. Important lessons for patients and consumers too with the suggestion that it is unethical to diagnose and treat over the internet or in a single email.
Remote diabetes monitoring Farmer et al (2005)	A systematic review of clinical studies using electronic transfer of blood glucose results in people with diabetes. RCT results were pooled and meta-analysis performed. Although electronic transfer of glucose results appears feasible in a clinical setting, studies were small scale and only 3 extended to over 1 year. Studies did not provide evidence that intervention was effective in reducing HbA(1C) or reducing costs or other aspects of diabetes management.
Mass media interventions: effect on health services utilisation Grilli et al (2002)	A Cochrane systematic review looking at the role of mass media (radio, television, newspapers, magazines, leaflets, posters and pamphlets) in influencing the use of health care interventions. This is an important systematic review on a broad range of media interventions showing that despite poor quality of some research there is evidence that channels of communication have an important role in influencing use of effective services and discouraging use of unproven effectiveness.
Mass media interventions in HIV and AIDS testing Vidanapathirana et al (2005)	A systematic review to assess the effect of mass media interventions and the most effective form of mass media intervention at a general population level or in specific target populations, in relation to changes in HIV testing, compared with a control group or with pre-intervention levels. This review demonstrates that mass media campaigns designed to raise awareness of HIV and AIDS have shown immediate and significant effects in the promotion of voluntary counselling and testing for HIV,

	but no significant long-term effect, likely due to the short duration of the campaigns.
Remote care of cardiac patients Haley et al (2004)	A systematic review of assessment of telecardiology from 1992-2003 identifying 44 studies meeting selection criteria. Highest quality studies were found on home care applications such as management of heart failure while paediatric and non-emergency adult hospital applications were of poorer quality. No convincing data on influence on health outcomes or cost effectiveness.
Health outcomes in both home-based and office/hospital-based delivery of care Hersh et al (2001)	The objective of this systematic review was to evaluate the efficacy of telemedicine interventions. A total of 25 articles met inclusion criteria and were assessed. The strongest evidence for the efficacy of telemedicine in clinical outcomes comes from home-based telemedicine in the areas of chronic disease management, hypertension, and AIDS. The value of home glucose monitoring in diabetes mellitus is conflicting. There is also reasonable evidence that telemedicine is comparable to face-to-face care in emergency medicine and is beneficial in surgical and neonatal intensive care units as well as patient transfer in neurosurgery.
Economic evaluation of remote care in Mental Health Hyler et al (2003)	The issue of whether telepsychiatry is worth the cost or whether it pays for itself is controversial. This study investigated this question by reviewing telepsychiatry literature that focused on cost. The methods of examining cost used in the 12 studies were cost-feasibility, cost surveys, direct comparison of costs of telepsychiatry and in-person psychiatry, and cost analysis. It was concluded that in seven of the studies reported, telepsychiatry was worth the cost. One study reported that telepsychiatry was not financially viable. Three studies of cost-effectiveness reported the break-even number of consultations, the number that make telepsychiatry comparable in cost to in-person psychiatry.
Clinical Outcomes in remote areas in Mental Health Hyler et al (2005)	Systematic review and meta-analysis of studies published between 1956 and 2002 included 14 studies comparing telepsychiatry with in-person psychiatry and high versus low bandwidth telepsychiatry. The study suggested no difference between telepsychiatry and in person psychiatry in terms of accuracy or satisfaction although anecdotal evidence suggested higher bandwidth was slightly superior for assessments requiring detailed observation of subjects. Authors expected telepsychiatry to replace in person in certain research and clinical situations.
Use of Simulation in Medical Training Issenberg et al (2005)	Systematic review on the use of simulations in medical education selected 109 studies meeting criteria. Medical simulations facilitate learning under the right conditions. These include providing feedback, repetitive practice, curriculum integration, range of difficulty level, multiple learning strategies, capture clinical variation, controlled environment, individualised learning, defined outcomes and simulator validity.
Remote nursing care of the elderly Jones and Brennan (2002)	A systematic review of research published 1966-2001 on telehealth interventions in clinical nursing of elders. 18 reports described 8 projects showing limited quality evidence based studies.
Use of personal digital assistants (PDAs) in clinical care Kuziemsky et al (2005)	The review shows while adoption and usage of PDAs as an ICT intervention is accepted, there are still very few studies that provide evidence about their impact on patient outcomes.
Patient satisfaction with remote consultations Maier and Whitten (2000)	A systematic review of studies published between 1966 and 1998 found 32 studies, all reporting good levels of patient satisfaction with clinical consultations between health care providers and patients involving real time interactive video. Methodological problems noted.

Appendix 2: Methodology

Seven researchers based in the United Kingdom (UK), United States of America (USA), Kenya, Senegal, Australia and Colombia completed a broad search for relevant material. We searched a wide range of bibliographic databases and websites, conducted key informant interviews, and drew upon an international online consultation process to identify additional published or unpublished material. This was subsequently supplemented by the peer-review process for the framework paper, which helped to identify further relevant materials.

Other outputs in the four month study have included the development of a fully searchable database of many of the most important materials on this topic, which it is hoped will prove to be a resource for policy makers and practitioners in the health and ICT sectors. Further outputs have included the conducting of an online discussion (summary available), and development of key lists of major themes and a literature review. All these outputs are available online at http://www.asksource.info/res_library/ict.htm.

Where databases permitted the search strategy was adapted as appropriate to search the other electronic databases using subject headings. The full search strategy for EMBASE, MEDLINE, CINAHL, HMIC are available on request.

Researchers selected material published since 2000 including material published 2000 to date and in particular looked for Bibliographies, mapping or scoping exercises, systematic reviews, research studies, review articles, policy discussions, case studies with wider policy implications or discussion of lessons learned. Individual case studies or descriptions of projects with no listed outcomes or wider implications were noted separately. no language restrictions were applied, although most databases or sources had English, Spanish or French language focus.

Key words used in the search strategy included:

Distance education (education, distance)	Medical informatics
Distance learning	Personal digital assistant (PDA)
Ehealth (e-health)	Radio
Electronic records	Satellite
Handheld compters (computers, handheld)	Telehealth (tele-health)
Health	Telemedicine (tele-medicine)
Health information technology	Teleradiology (tele-radiology)
Information and communication technology	Videoconferencing

For this Framework paper the following key words were used to further narrow the selection of articles.

AIDS	infectious disease
Barriers	malaria
Child health	maternal health
Child mortality	Millennium Development Goals
childbirth	Paediatrics (pediatrics)
children	Partnership.
Donors	philanthropy
education	policy
environment	poverty
Gender	Pregnancy
global health	sustainability
HIV	tuberculosis
Hunger	woman's health

Material meeting the inclusion criteria was reviewed and bibliographic data entered onto an interactive database housed at the Source International Information Centre (see http://www.asksource.info/res_library/ict.htm. Keywords and abstracts were added to each record

which categorised the material according to taxonomy for ICT, Millennium Development Goals and WHO Public Health Functions.

Emphasis for selection was placed on the following types of articles:
1. Published Articles from 2000 to date
2. Systematic Reviews
3. Peer reviewed Non-systematic Reviews published in reputable journals without comercial conflicts of interest
4. Randomized Controlled Trials
5. Non-randomized controlled trials with specific outcome indicators measured
6. Published International Agency and Government Policy Statements
7. Published Editorial and Opinion Based materials with policy implications

List of sources
Standard Databases:
PubMed, EMBASE, CINAHL, PsycINFO, Health Management Information Consortium, LILACS, Scielo, Cochrane Database of Systematic Reviews, Database of Reviews of Effects, Cochrane Central Register of Controlled Trials, HTA, NHS EED, TRIP database, Current Contents, SUMsearch, Popline, ERIC, Web of Knowledge, Academic Search Premier, CISTI, TOC Premier, CISMeF, ELDIS.

Non-standard database sources:
(These were mainly identified through web sites)

International Agencies: Development Gateway, ILO, ITU, FAO, UNAIDS, UNDP, UNESCO, UNFPA, UNICEF, UN ICT Task Force, UNIFEM, World Bank, WHO, WSIS

Bilateral donor agencies: CIDA, Danida, DFID, DGIS, European Union, Norad, SDC, SIDA

Trusts and Foundations: Dreyfus Health Foundation, Health on the Net Foundation, Hesperian Foundation

Civil society organisations: AfriAfya, Africa Journals Online, AMREF, Arab Resource Collective (ARC), Asociación para el Progreso de las Comunicaciones (APC), Association for Health Information and Libraries in Africa (AHILA), BioMed Central, Bireme (Biblioteca virtual em saude), Child-to-Child Trust, Communication Initiative, Digital Dividend Project, Electronic Publishing Trust for Development (EPT), Engender Health, Exchange, Family Health International, Free for All, Gamos, Health Communication Materials Network (HCMN), Healthlink Worldwide, IDRC, IIDC, Indian Medlars, Interactive Health Network, INASP, International Health Impact Assessment Consortium (IMPACT), IPPF, ITDG, Media Materials Clearninghouse (MMC), NGO Networks for Health, OneWorld, PANOS, Partnerships in Health Information (Phi), PATH, Popuation Council, PubMed Central, Reproductive Health Gateway, Reproductive Health Outlook, SAInfo (South Africa), SatelLife, Scientists for Health and Research for Development (SHARED), Source, South African Medical Database (SAMED), Telemedicine Information Exchange, WWW Virtual Library

Appendix 3: Acronyms used

AIDS	Acquired Immune Deficiency Syndrome
ART	Antiretroviral Therapy
ARVs	Antiretrovirals
BBC	British Broadcasting Corporation
BCC	Behavior Change Communication
CFSC	Communication for Social Change
CSO	Civil Society Organisation
DFID	Department for International Development
FAO	UN Food and Agricultural Organisation
FBOs	Faith Based Organizations
FHI	Family Health International
GFATM	Global Fund for AIDS, TB and Malaria
HDR	Human Development Report
HIV	Human Immunodeficiency Virus
ICTs	Information and communication technologies
IEC	Information, Education and Communication
MAP	Multi-country AIDS Programme
MDGs	Millennium Development Goals
NGO	Non-governmental organisation
PLWHA	People living with HIV and AIDS
PMTCT	Prevention of Mother to Child Transmission
STI	Sexually Transmitted Infection
TAC	Treatment Action Campaign
UNAIDS	Joint UN Programme on HIV and AIDS
UNESCO	UN Educational Scientific and Cultural Organisation
USAID	United States Agency for International Development
VCT	Voluntary Counselling and Testing
WHO	World Health Organization
WTO	World Trade Organization

Appendix 4: Definitions used

Information and communication technologies (ICTs)
ICTs have been defined by different commentators in various ways (UN ICT Task Force, 2003; Skuse, 2001; Michiels and Van Crowder, 2001; World Bank, 2003; Greenberg, 2005 and Weigel and Waldburger, 2004). Many definitions focus particularly on the 'newer' computer-assisted, digital or electronic technologies, such as the Internet of mobile telephony. Some do include 'older' technologies, such as radio or television. Some even include the whole range of technologies that can be used for communication, including print, theatre, folk media and dialogue processes. Some focus only on the idea of information handling or transmission of data. Others encompass the broader concept of ICTs as tools to enhance communication processes and the exchange of knowledge.

For the purposes of this study, ICTs are defined as ***tools that facilitate communication and the processing and transmission of information and the sharing of knowledge by electronic means***. This encompasses the full range of electronic digital and analog ICTs, from radio and television to telephones (fixed and mobile), computers, electronic-based media such as digital text and audio-video recording, and the Internet, but excludes the non-electronic technologies. This does not lessen the importance of non-electronic technologies such as paper-based text for sharing information and knowledge or communicating about health, but merely draws a boundary around the field addressed by this document.

Medical, health, and healthcare informatics
These terms first appeared in the 1960s, and refer to the knowledge, skills, and tools that enable information to be collected, managed, used, and shared to support the delivery of healthcare and to promote health (NHS, 2006)

Medical/health technologies
A simple definition, produced by the World Health Organization (WHO – 2004) is that health technologies are solutions to health problems. They are essentially any tools, devices, or procedures used in health care. This can include ICTs, and when it does, these are usually categorized as:

- Diagnostic Technologies – electrocardiography, electroencephalography, myography, x-ray imaging, fiberoptic endoscopy, computerized tomography, magnetic resonance imaging, ultrasonography, coronary angiography, non-invasive functional organ studies, radionuclide uptake and imaging diagnostic procedures, biochemical, hematological, serological, microbiological, and tissue pathology analytical studies, genetic analysis.
- Therapeutic Technologies – including curative and preventive technologies such as pharmaceuticals, laparoscopic and laser surgery techniques, vaccination, radiation by external sources or radionuclides, and the evolving applications of genetic engineering and gene therapy to human disease,
- Information Technologies – including manual and computerized data systems, medical records, clinical and administrative documentation, communication resources, fax machines, telephone, e-mail, the Internet, handheld computers and portable digital assistants (PDAs), electronic medical records, and "smart cards".

Telemedicine, health telematics
Telemedicine is the delivery of health care services, where distance is a critical factor, by health care professionals using ICTs for the exchange of vital information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interest of advancing the health of individuals and their communities (WHO, 2004). WHO also describes health telematics as a composite term for health-related activities, services and systems, carried out over a distance by means of ICTs, for the purposes of global health promotion, disease control, and health care, as well as education, management, and research for health. More restrictive terms that are part of telemedicine include: teleconsultation, telediagnosis, remote second opinion, teleradiology, telesurgery, telecare, teleducation and teletraining.

E-health
E-health is the use of emerging information and communication technology, especially the Internet, to improve or enable health and healthcare (Eng, 2001). This term bridges both the clinical and non-clinical sectors and includes equally individual and population health-oriented tools. Eysenbach (2001) elaborated on this further and Pagliari, et al (2005) explored the literature to identify 36 definitions of e-health before refining Eysenbach's to read: 'e-health is an emerging field of health informatics, referring to the organisation and delivery of health services and information using the Internet and related technologies. In a broader sense, the term characterises not only a technical development, but also a new way of working, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology'.

Health system
The health system includes all activities with the primary purpose of promoting, restoring or maintaining health. This includes, but is not limited to, the preventive, curative and palliative health services provided by the health care system (WHO, 2000).