

Improving health care in rural areas: Information and communications technology solutions for least developed countries

The Millennium Development Goals (MDGs) set targets to address the most critical areas affecting development by 2015. In the area of human health, such targets include the reduction of the mortality rate of children under five years old by two thirds (MDG 4), the reduction of the maternal mortality ratio by three quarters (MDG 5) and the halting and reversing of the spread of HIV/AIDS, malaria and other major diseases (MDG 6).

The Asian and Pacific region suffers 41% of the world's deaths of children under five and 43% of the world's maternal deaths. It leads by far in the prevalence of tuberculosis, with more than 8 million people affected, as illustrated in figure 1. The rate of infant mortality is almost twice that of Latin America and the Caribbean.¹ Between 2001 and 2007, the number of people living with HIV nearly tripled in the Pacific and increased by one and a half times in North and Central Asia.¹ Recent threats, such as the H1N1 2009 flu pandemic, further affect the health of children, pregnant women and the population at large.

Moreover, health-care facilities and personnel are more concentrated in urban areas than in low population density areas. In the region, child under-

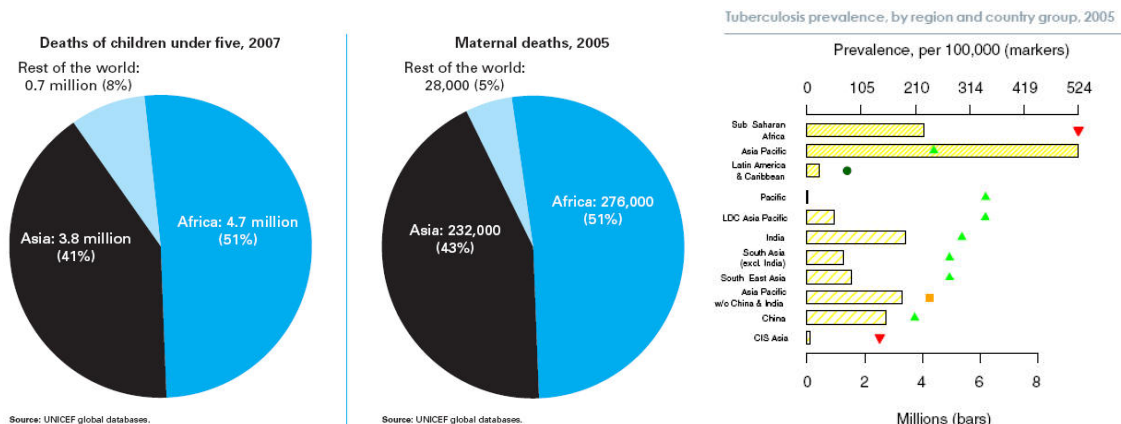
five mortality rates are typically far higher in rural than urban areas, often by over 50 per cent.²

It is recognized among health specialists that achieving the health-related MDGs requires strengthening health systems, particularly in the following areas:

- Expanding the primary health-care workforce and enriching the skill levels;³
- Upgrading and broadening medical infrastructure and logistics;³
- Providing affordable access to drugs and medical supplies;⁴
- Improving health decision-making and early warning by enhancing data collection and analysis of disease trends.³

This brief summarizes cost-effective information and communication technology (ICT) applications to support improvements in these four areas in least developed, landlocked and small island countries in the Asia-Pacific region, and recommends policy options to better benefit from such applications.

Figure 1. Indicators related to the MDGs 4, 5 and 6



Source: Tuberculosis: The Millennium Development Goals: Progress in Asia and The Pacific 2007.

Expanding the health-care workforce and enriching the skill levels in rural areas

The Asia-Pacific region is underserved by health-care workers (20 per 10,000 persons in 2007). This is a consequence of factors such as emigration, low levels of investment in human resources and poor working conditions. To address this problem, ICT can be applied in the following areas.

ICT Training for health workers in rural areas

ICT can be used to provide cost-effective and efficient training and to develop skills among local health workers, resulting in not only better skilled health workers but also an increase in the number of trainers. With distance learning and computer-based training, trainees can study independently using standardized materials on CD-ROM, the Internet, and using video-conferencing facilities. This mode of learning may be used as a substitute or complement to training activities which do not require or need fewer hands-on demonstrations by an instructor. Training materials which use multi-media technology can illustrate medical cases and transfer skills and knowledge in interactive ways, which are not always possible in traditional classrooms. Computer-based training has proven to be cost-effective and of equivalent quality to classroom training for first-level health providers in least developed countries. A study comparing the results of a computer-based training and a standard training for the Integrated Management Childhood Illness (IMCI) found that there was no difference in the level of knowledge and skills acquired between the two methods, and ICT-based training may decrease the time and number of facilitators, resulting in cost savings of almost 30 per cent.⁵

ICT for skill building in health services

Providing health workers with tools and information that complement their skills is another way to strengthen health services in rural areas. Free basic health reference materials are increasingly available on the Internet, such as <http://healthy-india.org/> in India and the self-help guide provided at www.nhsdirect.nhs.uk, which can be useful to health workers as well as the population at large.⁶

These reference materials and diagnostic tools can be accessed on affordable portable computers and even from some mobile phone handsets. For example, a University of Melbourne project installs reference materials and calculators for determining drug dosage on mobile telephones used by health workers in rural areas of developing countries.⁷ Similar portable tools could also be directly used by people who may not have access to a health worker.

ICT for Tele-consulting

Telemedicine refers to the remote diagnosis and consultation of patients by doctors without being in physical contact. The parties may be separated by long distances and be located in under-served and rural areas. It includes tele-consulting, which in its simplest form involves the exchange of health information by voice between a doctor and a rural health worker assisting a patient. Tele-consulting "call centres" can be established to provide rural health workers, who may have limited medical skills, with a dedicated phone line to consult with more specialized doctors.

Limited scope call centres have been successful in many developing countries in providing access to medical advice through free or low-cost telephone numbers to people facing social pressure not to solicit advice for certain illnesses, such as sexually transmitted diseases, HIV/AIDS and mental health problems.

Telemedicine also includes tele-radiology, tele-pathology, and the provision of surgery advice and instructions, all of which involve the transmission of images among different sites.⁸ With the increasing availability of connectivity in rural areas and the reduced prices of communication devices, some of these applications are more accessible to least developed countries. Examples include sending text message reminders for taking medication and vaccination follow-ups. In Thailand, tuberculosis patients receive daily text message reminders, resulting in over 90 per cent adherence.⁷

Public awareness

One precondition for halting the spread of HIV/AIDS, malaria and other diseases, such as H1N1 flu, is for people to understand how these illnesses are transmitted. Mass media health awareness campaigns have proven to be effective, though in some cases they may be expensive. In such cases, targeted campaigns through local radio and mobile phones could be an alternative. Mobile phones provide a high penetration level and an additional level of privacy not offered by other mass media. For example, in some countries, governments are sending text messages to mobile phone users to promote HIV/AIDS testing and awareness hotlines; in one such case, the campaign resulted in a considerable increase in calls to the hotline.⁷ However, legislation is required in order to ensure that such information comes from credible sources.

Upgrading and broadening medical infrastructure and logistics

Most of the least developed countries do not have

enough resources to establish new primary health-care facilities in rural areas; the selection of their locations is therefore critical. Geographic information systems (GIS), which integrate and analyse relevant geographical and demographic data, have been helpful in identifying locations which are safe from disasters and easily reachable by a large portion of the population, and which may be particularly disease-prone. For example, WHO distributes the HealthMapper system, which facilitates data collection, updating and visualization of health information in the form of maps, tables and charts.

ICT can support building the necessary health infrastructure in developing countries in several ways. Examples include public-private partnerships for the construction and operation of health-care facilities. Additionally, ICT can facilitate the sharing of information, such as clinic construction blueprints, ready-made public health awareness materials, free software in local languages for managing health-care centres and electronic processing of permits and other paperwork.

Providing affordable access to drugs and medical supplies

Market efficiency: In most developing countries, there have always been considerable gaps between the demand for and supply of drugs and medical equipment/tools. Furthermore, their prices depend on various factors, including import tariffs and the availability of local generic alternatives to brand name drugs. In countries where the government procures drugs or medical supplies directly with public funds, decision makers at the national and provincial levels look into pooling purchases into higher volume orders to obtain better prices. When rural health-care centres are provided with sufficient means of communication, they can inform provincial health centres about their inventory of medicines. Such information can be aggregated in inventory systems and used to allocate medicines in response to actual demand in each province.

In situations where the markets have multiple buyers and sellers of drugs and medical supplies, information on supply and demand makes prices more competitive. Governments worldwide have been promoting the establishment of electronic marketplaces which provide business directory listings and electronic catalogues and facilitate transactions between buyers and sellers.

Scientific information for producing affordable drugs: An alternative to procuring drugs is producing them. Some developing countries have developed pharmaceutical industries capable of manufacturing generic drugs. To foster health research, individuals and companies need access to academic and field research, some of which is readily available online,

though often at a high price. The Governments of least developed countries may seek partners to gain access to these resources. For example, the Health InterNetwork Access to Research Initiative (HINARI), a public-private partnership set-up by WHO, provides LDCs free access to expensive knowledge bases containing biomedical and health literature materials (www.who.int/hinari/en).

Early warning and surveillance systems for health care

Health early warning systems are surveillance systems that collect information and apply statistical methods to detect changes in general health trends and epidemic-prone diseases. Such systems depend on data being collected, analysed, interpreted and made available to decision makers and the community.

Data collection using multiple platforms: Having knowledge about the health situation of people dispersed over large rural areas has long been a challenge, but thanks to the reduced cost of hand-held electronic devices, ambulatory health-care workers can report their findings easily and rapidly back to headquarters. Data can be aggregated at provincial or national databases, resulting in better individual patient records, avoidance of paperwork backlogs and the availability of up-to-the-minute health reports and maps. For example, EpiSurveyor, a software application promoted by the United Nations Foundation and the Vodafone Foundation, enables surveys to be created easily using mobile phones.⁷

Fieldwork data collection is slow and expensive. Space agencies are working on developing models using data obtained from satellites which measure conditions such as temperature, rain precipitation and other factors to infer the probability of the spread of diseases such as malaria, sleeping sickness, dengue fever, rift valley fever and chikungunya.⁹ Remote sensing technology may be used to analyse bird migration routes in order to identify areas where outbreaks of diseases, such as avian influenza, might occur.

Analysis and decision making: Health policy- and decision-makers need tools to assist them in their work. Such tools include spatial information systems designed to integrate and analyse historical and real-time data and to display it in user-friendly ways. Such systems can combine multiple layers of information obtained on the ground and from satellites. This information can be linked to statistical databases, for example, those with figures on population density, resulting in maps on which disease-prone areas can be identified. Furthermore, such information could also be used to establish spread models of certain infectious diseases, to identify areas requiring urgent assistance and to compare the solutions for more effective control and prevention of their spread.

Challenges and recommendations for improving health care in rural areas using ICT

It is important to recognize that ICT-based solutions should be an integral part of a country's health policy rather than being limited to the ICT Ministry/Department. It is therefore recommended that the necessary capacity-building in the health sector be made at the policy, institutional and technical levels. Bearing in mind the trends and good practices described above, the following recommendations, addressed primarily to health-care policymakers, have been made with a view to integrating the ICT and health-care sectors.

Promoting ICT to enrich the skills of health workers in rural areas: Health workers in least developed countries may lack the ICT skills required to benefit from online medical resources, distance learning or computer-based training. Least developed countries often lack qualified technical staff capable of supporting the national ICT infrastructure and developing applications, as well as training users.

Recommendation: In order to expand the health-care work force and enrich their skills, health policymakers should invest in developing training and reference materials for distance learning through mobile phones and the Internet and encourage health workers to use these resources. In parallel, such initiatives may be supported by advisory call centres established to reinforce the skills of health workers.

Additionally, in order to develop sufficient human capacity to maintain the telecommunications infrastructure, ICT policymakers should seek to strengthen ICT education among the population as early as possible and promote the translation of open source software into local languages.

Promoting ICT applications: It is challenging to develop easy-to-use tools and applications which are available in local languages and utilize the existing infrastructure, such as the Internet and mobile telephones, efficiently.

Recommendation: To make the drug and medical supplies markets more transparent and efficient, health policymakers should support the establishment of tools such as government procurement websites and private electronic marketplaces. Policymakers in countries that have no legal frameworks regulating electronic commerce may consider adopting the United Nations Commission on International Trade Law model for electronic commerce laws.

In addition, health policymakers should invest in easy-to-use and customized ICT applications and promote online or CD-based training and knowledge sharing tools in local languages so that health-care stakeholders can share good practices for building and operating health infrastructure (for example, public health awareness materials, clinic construction blueprints and management software).

Given the extraordinary growth of mobile phone use in rural areas, incentives should be given to encourage the development of local-language health applications and awareness campaigns through these devices.

Infrastructure and connectivity: The challenge most least developed countries face is the limited amount of financial resources available to invest in expanding ICT connectivity to rural areas. Until the economic crisis and its severe social impacts are overcome, it will likely be difficult for policymakers to obtain significant funding for investment in ICT for health from national budgets. In addition, making a case for investing in projects not directly related to health care rather than new clinics, drugs or medical equipment is a challenge.

Recommendations: In the constraining situation of resource generation, it is important to make better use of existing technologies, such as radio, television, satellite television, mobile phones, and satellite-based voice and data links.

Health policymakers should collaborate closely with other government sectors to deliver education, government services, business opportunities and improved health-care through community centres connected with ICT. In other words, the business case for public spending in ICT connectivity should not be seen in isolation, but rather holistically as part of a broad strategy to improve the quality of life and reduce poverty.

At present, most demographic and socio-economic data are being shared across and within the countries using National Spatial Data Infrastructure. These data could be used for the development of health-care systems and responses to public health events, such as the spread of certain infectious diseases and pollution events driven by socio-economic and environmental conditions.

Finally, policymakers should explore policies that reduce trade barriers on ICT equipment or give consumers and businesses tax incentives to purchase ICT equipment. An alternative means of obtaining financial resources for investing in ICT infrastructure is to implement universal service obligation funds.

Policy and legal framework: The regulation of commerce in drugs, medical equipment and services is challenging. Often, patients receive poor treatment from unlicensed medical practitioners and incorrect information from poor quality sources; they may also obtain low-quality counterfeit drugs in their local markets. With the use of new technologies, some of these problems will be exacerbated and the risk that patient privacy may be violated will increase.

Recommendation: Health policymakers should review the legal framework regulating the provision of health services which use ICT to ensure that they are neither impeded nor abused. Policymakers should inform public and private health stakeholders of the existing regulations and the opportunities for provision of new types of health services. Policymakers may wish to include regulations to inhibit commerce in low quality drugs by using methods such as enabling the verification of a drug's authenticity by telephone. Legal frameworks should also ensure data protection and safe electronic exchange of patients' data.

Public-private partnerships to promote ICT for health care: The growth of the ICT sector is primarily driven by private industry, while the health-care sector in developing countries is largely driven by Governments. Developing infrastructure, ICT applications, human capacity and finding financial resources for delivering health services to rural areas requires collaboration between public and private sector stakeholders. Attracting these partners and coordinating their activities is a challenge.

Recommendation: Least developed countries should establish strong partnerships with private sector entities, as well as other countries and organizations to integrate ICT with the health-care sector. As the mobile telephone market is growing strongly in developing countries and telecommunication companies are competing vigorously for a share of it, policymakers may encourage mobile operators to develop and deliver public health services and applications through their devices. Such services can be of interest to operators as a way to attract new and loyal clients. Such partnerships may include the delivery of health reference materials and public awareness campaigns. On the other hand, least developed countries should join regional cooperation mechanisms with other countries that are willing to share their expertise and health research.

For further reading

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This Policy Brief on ICT Applications in the Knowledge Economy has been prepared by the Information and Communications Technology and Disaster Risk Reduction Division of ESCAP to provide a brief introduction on selected ICT applications, identify issues for implementation, and provide policy direction for the promotion of the applications. For further information on this Policy Brief, please contact: Mr. Xuan Zengpei, Chief, Information and Communications Technology and Disaster Risk Reduction Division (e-mail: xuan@un.org).