Extending x-ray vision

Teleradiology improves diagnosis and treatment for patients in rural Mali

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Using locally developed software, doctors in three rural hospitals in Mali can send x-rays via the internet for expert diagnosis and treatment recommendations. The success of this teleradiology project has led to further e-health initiatives in the country.

Mahamadou Konipé, remembers the time his ten-year old nephew, Bagna Touré, was in hospital in Mopti, a small city 600 km away from Mali's capital, Bamako. 'Bagna was admitted with a strange lump in his throat. One evening I arrived at the hospital and found his grandmother arranging all his personal belongings around him as if he was already on his death bed. No one knew what he was suffering from, except that he could no longer swallow anything. And the doctors did not know how to treat him.'

The local doctors decided to send x-rays to a radiologist, Dr Mamadou Touré, in Bamako. Dr Touré immediately saw that Bagna had a foreign body stuck in his gullet. He consulted his colleagues and, drawing on years of practical experience, he came up with the diagnosis and suggested treatment. Bagna Touré's life was saved because his doctors in Mopti were able to obtain an expert opinion quickly from the hospital in Bamako.

Despite a decentralized healthcare system, which was developed to allow the regional health services to adapt effectively to local needs, many people still have problems accessing professional healthcare in Mali. Medical cover is only available to 30-40% of the people living within a 15 km radius of a hospital or health centre. This is partly due to the lack of public resources and partly because qualified medical specialists are scarce and unevenly distributed throughout the country. In fact, 57% of specialized doctors, 67% of technicians, and 41% of midwives are located in Bamako. This inequality is even more evident in certain specialist areas such as radiology.

Most of the regional hospitals in Mali have an x-ray machine, but there are only 13 trained radiologists in the whole of the country, and all of them are located in Bamako where they have better career perspectives and salaries. As a result, doctors in the regional hospitals often have to refer their patients to the national hospital in the capital for an expert diagnosis of the x-ray and to determine the best course of treatment. For some patients, this can mean a journey of more than 1000 km. Not everyone can afford to make this trip or is fit enough to travel.

Bagna Touré was lucky as the hospital he went to participates in a project operated by the Malian Society for Medical X-rays (Société Malienne d' Imagerie Médicale, SOMIM). The project, currently running in three rural hospitals, enables doctors to link to medical experts in other hospitals via the internet.

Second opinion

Dr Touré, also the chairperson of SOMIM, decided to try out different ICT applications to connect the rural healthcare facilities to the specialist radiologists. His idea was to train medical staff in regional hospitals to make x-rays and set up internet connections between the three rural hospitals and the academic hospital, known as Point G, in Bamako.

Each regional hospital received a desktop computer, a digital camera and a scanner. Each hospital appointed staff members to be trained to make a digital copy of an x-ray using the scanner and send it to the radiologists in Bamako. Regional doctors can now check their diagnosis with an expert at Point G and ask for treatment advice without the patient having to travel all the way to the capital. Not only does this save patients time and money, it also helps to prevent medical errors caused by wrong diagnosis and incorrect treatment in the rural hospital. Moreover, doctors feel less isolated and enjoy the opportunities to improve their own skills through peer-to-peer review and distance training.

The hospital sends the x-ray images using locally developed open source software called OpenYalim. There are other e-health software platforms available but most were too expensive and none were suitable for the specific needs of this project. Much of the existing software was developed for scientific purposes and therefore not useful for the daily consultations necessary for the teleradiology project. The lack of broadband internet connections in Mali also ruled out some types of software that rely heavily on the transfer of large data files.

The only option, therefore, was to develop new open source software and a local company, ICT Development Centre (IDC) provided the solution. IDC developed a platform that the hospital staff involved in the teleradiology project could use to transmit, examine and archive responses to specialist requests. The software also encodes the data to protect the patient's privacy.

When one of the regional hospitals needs a consultation, the staff member simply creates a new patient file in the system, adds the clinical data and x-ray images and transfers all the information via the internet. At Point G hospital, the radiologist opens the file using the OpenYalim software, analyses the images and writes a report that same day. The original doctor who requested the diagnosis is then able to read the report as soon as the consultant adds it to the patient's file. In an emergency, the consultant can send back a report within one hour of receiving the x-ray.

Local support

Bagna Touré is just one of many patients who has benefited from the new teleradiology service. Within the first year of the pilot project, in 2006, the three hospitals sent 338 x-rays to Point G, an average of 30 x-rays per month. Out of these x-rays, 17 were urgent. In 2007, the project suffered problems with their internet connection resulting in a drop in the number of x-rays sent to Bamako. Only 166 were sent that year. The project team then invested in more robust modems for the regional hospitals that could cope with the irregular power supply. The new equipment solved the problems, resulting in a marked increase in x-ray transmissions, up to 479. This growth in number of transmissions indicates that using the teleradiology platform has become part of the hospitals' daily routine.

Despite the increase in demand on the time of such a limited number of trained radiologists, the doctors replied to 96% of requests from the regional hospitals within 24 hours. Out of the 983 x-rays that the regional hospitals sent for a second opinion in the past three years, 7% were considered urgent and were dealt with in a period of 10-15 minutes.

In a recent evaluation, the teleradiology service proved to be popular with both staff and patients. Only one patient was 'not very satisfied' at the length of time he had to wait for his report. From the medical staff, only 7% indicated that they were 'not very satisfied' with the teleradiology service. Their main complaint was that they would prefer to handle the whole process of scanning and sending the x-rays themselves.

It was clear, from the early stages of the project, that success of the service would depend on the availability of local technical experts to maintain the system and develop the relevant software. Similar electronic health (e-health) initiatives have failed in the past because of a lack of technical support and skilled developers. So far, the decision to ask a local company to develop the software has turned out to be a good one. By involving IDC, the teleradiology project has access to a pool of developers in Mali who are able to maintain and develop the OpenYalim software as well as any other applications that may be useful to the project.

One challenge remains, however, and that is retaining the software developers who have been trained by IDC. Software developers in Mali are still scarce and people easily

switch to better paid jobs. IDC found itself forced to give priority to developing applications that would generate immediate financial gain, resulting in unavoidable delays in the development of software, such as OpenYalim, for the social sectors.

Expansion
Another useful lesson learned from the teleradiology project is the importance of connecting doctors in rural hospitals to their peers where they can learn from each others' medical expertise. A lack of study material and information sources makes continuing education difficult in Mali, and many other ACP countries. The teleradiology project showed that doctors can gain a lot by interacting with other health professionals.

In response to the demand for greater professional cooperation, the Malian Medical Information and Communication Network (Reseau Informatique Malien d'information et de Communication Medicale, REIMICOM), an NGO that promotes the use of ICTs in the health sector, started a new project to develop a national web portal to provide information to health practitioners and the general public. The portal, which is still in the early stages of development, offers further learning and consultation possibilities to healthcare workers and provides the opportunity for the various Malian institutions to connect with each other.

By the end of 2008, six hospitals had been linked to the new portal with most visitors searching the site for publications provided by the University of Bamako. The university also adds weekly medical lectures from the University of Geneva which are free for anyone to download and have proven to be very popular.

However, to make the distance learning section of the e-health portal a success, the site will need to be updated regularly with new content. So far, visitors have only been accessing articles but have not submitted any content.

Broad appeal
The combination of these three projects – teleradiology, OpenYalim software development and the new e-health portal – show that a vast country such as Mali, with its limited resources, can still use ICTs to significantly improve the quality and availability of professional healthcare.

The services provided by the teleradiology project, for example, have proven to be very valuable, but it has also shown that any electronic transmission platform is dependent on the quality of the internet connection. Currently, two of the rural hospitals, in the towns of Kayes and Kidal, are still unable to participate fully as they do not have a reliable connection in their local area.

To overcome the problem of connectivity, however, the project team has recently started a pilot project with the European Space Agency to provide an internet link via satellite. Although expensive, satellite communication is currently the best solution to guarantee a continuous connection. The pilot project involves setting up and testing satellite connections in three hospitals, in Mopti, Timbuktu and Gao.
The private sector in Mali has also shown interest in the e-health schemes. The national gold mining company, which has a legal obligation to have its personnel (more than 1100 people) checked for respiratory problems once a year, are likely to start using the teleradiology services later in 2009.

If the model to provide satellite connectivity turns out to be successful, e-health could certainly take off, not only in Mali, but in other countries that currently experience similar problems. The Malian initiatives have already attracted a great deal of interest from neighbouring countries - Niger, Burkina Faso and Senegal - and have prompted them to think about developing a similar strategy for integrating ICTs into their own healthcare sector.

The projects in Mali show that, even with limited capacity, healthcare providers can still make significant improvements by connecting regional doctors to available specialists. Linking health professionals through technology is less costly, and often more efficient and convenient, than trying to distribute medical personnel throughout the country. This represents an important shift from the current methods of healthcare provision as it still recognizes the need for rural communities to have hospitals, but shows that the presence of a medical specialist on site is perhaps not always necessary.

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Related resources

Malian Medical Information and Communication Network
REIMICOM operates the Malian e-health portal. The organization also promotes telemedicine in Mali and supports the continuing education of medical professionals through distance learning.
 Network in French-speaking Africa for Telemedicine (RAFT)
RAFT provides interactive courses, in English and French, targeted to physicians and other care professionals working in West Africa.

OpenYalim e-health software
OpenYalim was published under a general public licence which makes it free from any restrictions on its use and redistribution. This makes it possible for the rest of Mali, or any other project, to use this software within their own e-health activities.

ICT Development Centre
IDC specializes in developing and adapting ICT tools to help achieve the United Nations' millennium development goals, and has a strong focus on e-health systems. The company also offers consultancies and training opportunities in open source software development.

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