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Using mobile phones in HIV care and prevention

By Carole Leach-Lemens

Mobile phones are one of the fastest spreading technologies in the world, and they are now being used for more than just making calls. Like SMS, or text, messaging, users are adopting the devices – and the technology – to completely new ends never envisaged when mobile phones first began to be adopted widely in the late 1990s.

With an estimated 2.2 billion mobile phone users in the developing world (64% of the global market) mobile phone technology presents a great opportunity and potential to address and positively impact the many health challenges facing resource-poor countries. This is commonly referred to as mHealth, a sub-segment of the field of electronic health (eHealth). The public health community essentially uses the following working definitions:

- "eHealth: Using information and communication technology (ICT) - such as computers, mobile phones, and satellite communications - for health services and information.
- mHealth: Using mobile communications - such as Personal Digital Assistants (PDAs) and mobile phones - for health services and information."[1,2]

In 2005 the World Health Organization (WHO) proposed the use of low-cost technology (eHealth) to improve the quality of health care delivery particularly at the primary healthcare (PHC) level, as well as build health worker capacity in resource-poor countries.[3]

The mobile phone is accessible in even the most remote areas of the world where oftentimes access to clean water, medical personnel or health facilities do not exist. A tool remarkable in its simplicity has already dramatically changed how societies and communities interact on a personal and professional level and the promise it offers health care is no less remarkable.

Six key applications in HIV have already emerged:

- **Supporting adherence**
- **Sending basic prevention and other health messages**
- **Hooking people into services, especially VCT**
- **Supporting health workers to do their jobs, saving time and increasing the operational efficiency of services**
- **Improving the efficiency of data gathering and analysis for service management purposes**
- **The adaptation of phones to provide a portable diagnostic device**

This article reviews some case studies of service developments that reflect these applications.

The potential

Since the 1990s ICT projects have proliferated in the developing world, yet surprisingly few have been considered a success. The case studies presented here are illustrative of the strength and depth of mobile technology in emerging markets in the developing world. Not only do they demonstrate the potential of eHealth as a powerful and effective tool to combat HIV and TB, but also to help address other global health problems in addition to providing (health-related) assistance during periods of crisis. The growth of mobile phones among the world's poor has overlapped with the global healthcare crisis and as such presents a potentially powerful and important health management tool.[4]

Mobile coverage in the developing world is rapidly increasing. Its reach is greater than any other technology or health-related infrastructure. By 2012 an estimated 50% of those living in remote areas will have mobile phones. For the most part mobile telecommunications infrastructure in Africa is too slow and too expensive for connecting computers to the Internet. Yet, low-bandwidth applications for mobile phones and personal digital assistants (PDAs) are available to connect via mobile networks. Most information designed for the web is too bandwidth-intensive for transmission over mobile networks but it can be formatted for small devices and low-bandwidth transmission.

Mobile phones and PDAs also offer the advantage of being sturdy (no moving parts), low-cost, providing immediate communication and they can be maintained in areas without electricity, for example with solar power chargers.[5] While use of the mobile phone among the world's poor is prevalent for personal and business use its potential use for health care is hampered only by an absence of imagination and failure to act.

Mobile technology is a tool that offers the potential for:

- decreasing the isolation of the healthcare community; making it possible for healthcare workers to provide real-time diagnoses and accurate health information in rural as well as marginalised areas where minimal or no health services exist
- improving access to care
- remote diagnosis, monitoring and evaluation
- improving quality, efficiency and cost-effectiveness of care
- tracking of diseases and monitoring of populations at risk
- enabling a faster and more co-ordinated response globally and nationally to disease events and natural disasters.[6]

A recent survey of non-governmental organisation (NGO) use of mobile technology for social change[7] revealed that 86% of NGO employees are using mobile technology in their work. Those working in Africa and Asia are more likely to use mobile technology than their colleagues working in areas with more sophisticated infrastructures and easy internet access. Of those surveyed 99% believed the impact of mobile technology to be positive. Close to a quarter deemed it as 'revolutionary' and 31% could not envisage doing their jobs without it.

Characteristics of successful pilots

The focus of the case studies presented here is primarily at the level of primary health care with particular attention paid to the role of community-based healthcare workers (CBHW). They all share criteria that make them successful pilots:

- Involvement of end-users from concept to completion
- Relevance and responsiveness to local needs and conditions
- Ease and simplicity of use – initial and ongoing training
- Immediacy
- Information and access in real-time

Such criteria have been described elsewhere as 'Real Access' and have been used to identify reasons for both the failure and success of ICT projects. The 'Real Access' criteria consist of the following 12 points:[8]

1 Physical access to technology
2 Appropriateness of technology
3 Affordability of technology and technology use

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4 Human capacity and training
5 Locally relevant content, applications and services
6 Integration into daily routines
7 Socio-cultural factors
8 Trust in technology
9 Local economic environment
10 Macro environment
11 Legal and regulatory framework
12 Political will and public support

It is generally acknowledged that the crucial issue is how to go from successful pilot to scale.[9,10] What are the necessary and optimal conditions? While the number of users or number of text messages sent can be documented there is no solid evidence-base yet to demonstrate the impact of these services on health outcomes.

The UN Foundation-Vodafone Foundation Partnership (UNF-VF Partnership) and Canada's International Development and Research Center (IDRC) are seeking to address this issue to improve health outcomes in resource-poor countries. The UNF-VF Partnership is working to set-up a unified global body (the mHealth Alliance) to promote best practices and commonly agreed standards for eHealth and IDRC is investing in the development of robust impact assessments. A unified body would ensure, to the degree possible, that knowledge and resources are shared. Costly repetition or re-inventing the wheel, a common practice in HIV where multiple, unco-ordinated efforts of international non-governmental organisations and donors overlap and compete, could be avoided.[11,12]

Case studies

Cell-Life: Cellphones4HIV

South Africa has one of the highest rates of HIV in the world with more than 5.6 million people living with HIV or one tenth of the population. The South African government began supplying antiretrovirals (ARVs) in 2004. An estimated 30% of those in need are now on ARVs. Successful treatment requires adherence and monitoring. With a weak healthcare infrastructure, lack of trained healthcare workers and a disparate system of rural clinics, consistent and adequate follow-up is a serious challenge.

Access to health care may be limited for most South Africans but over 80% have mobile phones (cell-phones), whereas barely 10% have access to the internet. Cell-Life was created to explore the opportunities this technology offers for HIV prevention and care.

The project is working to determine the impact of mobile phones for: mass-messaging for prevention; mass information for positive living; linking patients and clinics; building the capacity of the health system, peer-to-peer support and counselling; building the capacity of HIV-related organisations; and monitoring and evaluation. Formal research to measure the impact of these pilot studies has just begun.[13]

Cell-Life, a non-profit organisation based in Cape Town, South Africa, began as a community home-based care system, known as 'Aftercare', for the direct management of HIV patients and has since evolved to cover broader aspects of HIV management noted above. The project started as a joint venture between the University of Cape Town and the Cape Peninsula Institute of Technology. The project's objectives included: reduced treatment errors, improved comfort for the patient and increased quality of care, increased and improved quality of patient data.[14,15]

Central to Aftercare, a peer support home-based care model, are the volunteer community-based health workers (CBHW) who are themselves living with HIV. Each CBHW was assigned 15 to 20 people living with HIV. One-to-one sessions were held in the patient's home where information about medical status, drug adherence and other factors affecting ART was recorded. This information was then relayed via text message to a central Cell-Life database accessed by a care manager through a web-based system. The data are monitored and stored. At the same time the care manager can respond in real-time to the CBHW's questions and provide information that will improve patient care. A monitoring and evaluation system was built into the project.[16]

Initial results indicated improvement in quality of care. Success of this project was illustrated by the appropriate use of technology designed to address the end-users needs. Its simplicity, participatory approach and real-time feedback via text message all contributed to the positive outcomes. Familiarity with mobile phones was an important factor for rapid adoption. While the workload for CBHWs was increased, their competency was viewed as enhanced by their patients who cited an improvement in the quality of care received. In addition their status within their professional community was boosted by their eHealth work.[17]

Challenges were identified: long-term, financial sustainability is questionable, and there were difficulties in bringing it to scale. The system could only be used on one mobile-phone network using pre-paid accounts. The software used was written in English and would need to be translated into the 11 official languages of South Africa to effectively bring it to scale. Additional barriers for individual CBHWs were identified too. Personal security and fear of having the mobile-phone stolen was an issue. Some were concerned with the intrusion of their work into their personal lives.

Cell-life has been working to resolve these issues as their brief expands as described above. Funders now include the Vodacom Foundation, the Raith Foundation (an original funder), USAID-PEPFAR and Johns Hopkins Health and Education in South Africa.

Pilot projects include: working with Treatment Action Campaign (TAC) using text messages (SMS) to communicate within the Western Cape, supporting adherence clubs by sending reminders. A survey involving 140 club members was undertaken to determine self-reported ART adherence rates, TB co-infection and socio-economic data. Members were invited to sign up for twice-daily text messages which included a reminder to take ART, treatment literacy information, and positive living advice. Only three club members declined. Information sent was based upon the expressed interests of the survey respondents. Initial reports indicate the acceptance and popularity of using mobile phones in this way.[18] Formal research studies to measure the impact of mobile communications on prevention and adherence have been started.

Project Masiluleke

Project Masiluleke, another South African NGO, is using a free text message service (Please Call Me - PCM) to encourage HIV testing and counselling. Given that mobile usage is highest in the age groups most likely to be infected and undiagnosed, they hope to make a significant impact on reducing the numbers unaware of their HIV status by encouraging them to be tested, counselled and treated where eligible.[19]

The concept was born out of frustration and anger with the recognition that stigma associated with one's HIV status and with having TB contributed to the current situation.[20]

iTeach serves as the primary clinical site for Project Masiluleke. Zinhle Thabethe together with Krista Dong, M.D. started iTeach, an HIV/TB education, outreach and service organisation based at

Edendale hospital, one of the busiest in KwaZulu-Natal, the epicentre of South Africa's HIV epidemic.

Project Masiluleke consists of the following key components:

Phase one

1) One million text messages a day are currently being sent for a period of one year (365 million) to encourage people to be tested and treated for HIV and TB.[21]

Message content is supplied by iTeach, and MTN has donated space for the messages. The Praekelt Foundation provides the technology and frog design the design elements. Messages are sent in the unused space of 'Please Call Me'- a free text message service widely used in South Africa and across the continent. These free text messages allow individuals without phone credit to request a call back. The messages connect mobile users to existing HIV and TB call centres. Specially trained counsellors provide callers with accurate information as well as referrals to local testing clinics. Messages are written in local languages. Initial beta tests indicated that after three weeks of sending messages, calls to the National AIDS Hotline tripled.[22] A second phase is planned to expand geographic coverage. Careful monitoring and evaluation are integral to the project. Unlike radio and television advertising Please Call Me provides a direct and measurable link between use and end-goal: the number of people who saw the messages, how many called as a result and how many subsequently used the service can all be measured.

2) Txt Alert: Keeping Patients Connected to Care[23]

An automated text message reminder service was linked to the existing patient record data system at Thembu Lethu clinic in 2007 to improve clinic attendance for those receiving ARVs. Missed appointments were slightly higher for those not receiving reminders than those who did.

Phase two

Virtual HIV-positive call centres: The idea is that call centres will be staffed by teams of highly trained, highly adherent HIV-positive counsellors who will field questions remotely from their mobile phones.

Phase three

At-home HIV testing with Mobile Support: the project partners are actively exploring the possibility of an at-home HIV testing model with mobile counselling support, using a home testing kit. The concept parallels that of the home pregnancy kit. It is anticipated that such a model would provide a free, private and reliable way for anyone to find out their status. Information would be provided via a mobile device. Such a system raises many questions.[24]

Project Masiluleke is heralded as the world's biggest field trial of mHealth.[25]

Text to Change

In September 2008 Text to Change (TTC), a local NGO that uses text messages to provide HIV education in Uganda, partnered with the AIDS Information Centre (AIC) in Uganda and Celtel, a local mobile network to launch a pilot project in western Uganda to provide information about HIV and encourage subscribers to volunteer for HIV testing.

According to the Uganda Demographic Health Survey (DHS) an estimated 6 million Ugandans own mobile phones with 50% usage in urban areas and 10% usage in rural areas. DHS found that while most Ugandans are aware of HIV, comprehensive knowledge is estimated at approximately 30% for women and 40% for men.[26]

The pilot project, launched on Valentine's Day, ran for a six-week period. A list of 15,000 Celtel subscribers were sent an introductory text message and asked whether they would be interested in participating in a free interactive quiz about HIV. Incentives to participate included the offer of handsets and airtime for correct answers. Participation was anonymous.

Each week one question was sent. A correct answer was confirmed with a text message. An incorrect one received a corrected response. Approximately 2500 of the 15,000 responded to questions each week. At the end of the quiz a final text was sent encouraging participants to go for testing and counselling at the local health centre. The fee for the test was waived for TTC participants and brought about a 40% increase in the numbers getting tested over the six-week period.

Bas Hoefman, public relations officer at TTC thought that participation could be further increased by presenting the quiz in local languages. The quiz was interactive and focused on two specific areas: knowledge about HIV transmission and the benefits of testing and counselling.[27]

Mobiles in Malawi

"St. Gabriel's is certainly not alone in the challenges it faces as a rural healthcare provider. After witnessing the effects of simple ideas and equally uncomplicated technology on medical care, one thing was clear – each day that a clinic goes without tools they want and need is a day with undue hardship", says Josh Nesbit, a student at Stanford University who has been working with a mission hospital in Malawi to adapt mobile phone technology to the needs of local healthcare workers.[28]

An SMS-based communications network was set up for a rural hospital, St. Gabriel's, and its 600 volunteer community health workers (CHWs) in Namitete, Malawi in the summer of 2008 to help overcome the barriers that distance created for patients and healthcare workers alike. Active within the HIV-positive community, many of the CHWs were recruited through the hospital's ART programme to act as CHWs in their respective villages.[29]

St. Gabriel's serves 250,000 Malawians in 700 villages within a 100 mile radius. Access to the hospital for many involves walking or, for the more affluent, riding a bicycle over 100 miles. Access and communication was no less difficult for the CHWs and limited their abilities to help patients.

With a 15% HIV prevalence rate, widespread malnutrition and diarrhoea, multi-drug resistant TB and other opportunistic infections, the doctor ratio of one doctor for every 80,000 patients is typical of many rural areas in Africa.

The programme began with 100 recycled mobile phones and a donated laptop running FrontlineSMS:Medic – a free application that enables analysis of vast amounts of text messages without the need for a central server or internet access. This application acted as a central text-message hub and was placed within the hospital to co-ordinate the network's activities. "FrontlineSMS:Medic merges two pieces of open-source software. FrontlineSMS allows users to connect a SIM modem to a PC to create an SMS hub", the developers say. "Open MRS is an open-source electronic medical records system developed by Partners in Health and the Regenstrief Institute. Our platform integrates these tools and will enable two way communication between clinicians and health workers and text messages with patient data will automatically be entered into a unique medical record for individual patients."[30]

During the pilot study, CHWs were brought to the hospital in groups of 10 to 15 and trained in text messaging. Their locations were mapped and the phones were distributed throughout the service area.

The SMS network has had a positive impact on patient care and hospital operations.

- The hospital is able to respond to requests for remote patient care. The CHW will text the hospital when immediate care is needed and the patient will then be visited by the Home-Based Care mobile unit.
- Patients can be tracked. For example, if a TB patient should miss an appointment a CHW in close proximity is sent a text and can follow-up.
- Drug dosage and usage can be checked. CHWs are given basic drug supplies for primary care. When FrontlineSMS:Medic receives a drug name all information relating to dosage and usage is automatically texted back.
- CHWs are able to provide regular patient updates including deaths.
- Co-ordination of Home-Based Care visits is facilitated. The mobile unit texts a CHW who lives close to the patient to be visited to ensure the patient is at home and so avoid wasting precious travel time and fuel.
- CHWs communicate and collaborate with each other.
- HIV testing and counselling has been improved. Upon testing positive a patient is linked to a CHW with a phone. Support and close links to the hospital and care are maintained.

In a period of six months the SMS network saved the hospital an estimated 1200 hours of staff follow-up time and over $3000 in motorbike fuel. Close to 1400 patient updates have been processed through SMS. Over 100 patients have started TB treatment when their symptoms noticed by CHWs were reported by text message. The network has brought the Home-Based Care unit to the homes of 130 patients who might otherwise not have received care. Additionally texting has saved ART monitors 900 hours of travel time and eliminated the need to hand-deliver paper reports.

Within two weeks of setting up the operation the day-to-day management of the project was handed over to hospital staff.[31]

Josh Nesbit, founder of FrontlineSMS:Medic has compiled a guide on 'Building an SMS Network into a Rural Healthcare system' and in keeping with his philosophy, "This guide provides an inexpensive way to create an SMS communications network to enable healthcare field workers as they serve communities and their patients. The steps are purposefully simple - the system is easy to set up, use and maintain."[32]

Plans to scale-up the project will begin next year with a 500,000 patient study in Bangladesh, a co-operative venture with Brac, a development charity, Stanford Medical School and Independent University, Bangladesh. The goal is to roll out the current set-up to 30 sites in 20 countries over the next six months. Funding from the Clinton Global Health Initiative has recently been received for the development of a low-cost HIV test to be integrated into the text messaging system.[33]

Work has also begun on further development of the software through the open source community. The potential for the text messages to overload the current system is real. A common lesson emerging from the various eHealth pilot projects is that no matter where they operate the need is for them to be "as simple and user-friendly as possible, and the hidden back end should use sophisticated software and hardware." [34]

"The dream within two years is that you can be on a website, you can download our software, you can apply to get our hardware and you decide what to do with it. You the patient, you the health worker, you the clinician, who's on the front lines fighting this battle, you decide how it's used. That's a really exciting proposition."[35]

Earlier this week, FrontlineSMS:Medic launched the website: www.hopephones.org – a way for people to donate their old mobile phones for use by a medical clinic. For more information, see the website.

Uganda Health Information Network (UHIN) AED-Satellife

Access to information is no more available in many parts of Africa and especially rural areas, than clean running water, electricity or the internet. Quality of care is dependent upon the knowledge a nurse or CHW - often working alone - has retained and/or has access to. Personal digital assistants (PDAs) are handheld computers that make it possible to store, access and organise a considerable volume of information. PDAs can exchange data electronically with other devices. When telephone capabilities are included they are referred to as 'smartphones'.[36]

For six years AED-Satellife has pioneered the use of PDAs by health professionals working in resource-poor areas enabling them to receive and transmit important data where they are needed, at the point of care, enabling healthcare workers to make better informed treatment decisions. Information includes disease treatment information, treatment guidelines, newsletters, essential drug lists and databases via a wireless or mobile network. Customised software for data collection enables the health worker to track patients and maintain electronic records.

Initiated four years ago, the Uganda Health Information Network (UHIN) (a collaboration of the Ugandan Chartered HealthNet, Makerere University Medical School and district health authorities) is AED-Satellife's largest project using PDAs in Uganda, and now connects 175 remote health clinics serving an estimated 1.5 million people.

It began as a pilot project in two health districts. Project implementation was carried out by Ugandan workers from local and national health organisations co-ordinated by Makerere University Medical School. Information content was developed using a participatory approach involving local health workers (the end-users). It involved primarily digitisation of existing paper-based health data forms, decision support guidelines and educational materials. Training and technical support were provided throughout the initial phase. The two main applications were: 1) the health management information system and 2) the e-learning contents, which included locally developed and WHO guidelines for managing the health-related Millenium Development Goals (MDGs).[37]

Having translated the software and materials into Portuguese the project is now being replicated in 110 health centres in Mozambique and was launched in the spring of 2008 in South Africa. UHIN only gained support from the Ministry of Health once the project proved viable, three years into the project. Realising the importance of governmental support to ensure sustainability and capacity AED-Satellife chose to engage the Mozambique Ministry of Health as a partner from the outset.

An initial evaluation of UHIN revealed a 24% cost-saving over the traditional paper approach for recording data.[38]

Lessons learned over the past six years of working in resource-poor countries using PDAs for delivering and collecting health information have been incorporated into a 'PDA Toolkit' available from AED-Satellife.[39] The toolkit consists of a step-by-step guide on how to set-up and organise PDAs, including how to assess an organisation's readiness for using handhelds.[40]

Phones for Health (PEPFAR)

Phones for Health, a global public-private partnership, (composed of the GSM Association's Development Fund, Accenture Development Partnerships, Motorola, MTN, Voxiva and PEPFAR) is designed to use mobile phones for the collection and management of data, to order drugs and obtain treatment information.

Key objectives include:

- The development of an integrated set of standard information solutions that support the scale-up of HIV/AIDS, TB, and malaria services
- Using mobile phones for real-time data capture
- Delivering those solutions to countries in a way that is cost-effective, scalable and sustainable
- Help build the foundation for national Health Management Information Systems (HMIS).[41]

The partnership was piloted in Rwanda in 2006 through a project called called TRACnet with a focus on HIV/AIDS . Rwanda is a country of hills and muddy roads in the rainy season where information can take weeks to get from a remote village to a health centre. Phones for Health has revolutionised the way that information is received and used, enabling the Rwandan government to better track and manage the epidemic.

"With TRACnet, we have a powerful tool to manage the HIV and AIDS programme and deliver care to Rwanda's patients affected by HIV and AIDS. Healthcare workers use something as simple as a cellphone – even where there is no electricity – to report on the number of patients on treatment, drug stock levels and the other key data we need", said Dr. Agnes Binagwaho, Executive Secretary, Rwanda's National AIDS Control Commission. "Rwanda is the first country in Africa with a national-scale, real-time information system to manage its HIV and AIDS programme. We believe this can be a model for scaling up HIV and AIDS programmes across Africa and can be extended to TB, malaria and other diseases."[42]

The partnership is currently in the process of expanding to nine other countries in Africa.

Phones for Health is a system designed to enable health workers in the field, by using a standard Motorola handset equipped with a downloadable application, to enter health data. This data is then transferred through a packet-based mobile connection into a central data base. In the event that a mobile connection is not available the data can be sent via an SMS data channel. The system then maps and analyses the data which is available to health managers at all levels of the system.[43]

Timely receipt of accurate health data will enable health ministries to better plan, respond to and act on current and emerging epidemics as well as potential outbreaks in real-time.

Diagnostics

In most resource-poor areas the ability to perform even the most simple medical tests, such as blood counts, necessary to effectively treat diseases like HIV and malaria, is extremely limited. The capability to analyse samples in a simple and cost-effective way that requires minimal training is urgently needed. The mobile phone has been readily adapted for two diagnostic technologies already, *Cellscope* and *Cellophone*, described below. Both inventions won prizes in the Vodafone Foundation's Wireless Innovation Project earlier this year.

Cellscope

A project that began as a challenge to Dan Fletcher's undergraduate students at the University of California, Berkeley has turned a mobile phone into a diagnostic tool for malaria. The goal of the project is to bring modern diagnostic testing to remote areas cheaply and effectively via telemicroscopy.[44]

The Cellscope is a device that is attached to the digital camera of a mobile phone effectively turning it into a microscope. The Cellscope can show individual white and red blood cells. This means that with the correct stain it can be used to identify the parasite that causes malaria. This image could then be transmitted directly over the mobile network and so provide assistance with remote diagnosis and monitoring of illnesses.

Malaria was chosen initially since its diagnosis demands a high-quality image, but the invention is potentially applicable to any disease in which microscopy is required, such as TB. The team believes that minimal training would be needed to take and stain blood samples which could then be captured and sent to an expert for diagnosis.[45]

Cellophone

The aim of the Cellophone Project led by Dr. Aydogan Ozcan of UCLA is to provide a revolutionary optical imaging platform to be used specifically to analyse bodily fluids within a mobile phone.

The technology advanced by Dr. Ozcan and his team relies on what is termed as Lensfree Ultra-wide field Cell monitoring Array platform (LUCAS) and is based on shadow imaging. This technology counters the dominant thinking that has prevailed over the past few decades in the development of microscopes of building more powerful lenses or other advanced imaging apparatus. Shadow imaging of cells and bacteria relies on the detection of their shadow signature – the pattern of diffraction of waves by cells. Each type of cell has a specific electronic signature, or 'shadow', that can be detected.

No bulky attachments or components or lenses are needed and its developers say "...it can immediately monitor an ultra-large field of view by detecting the holographic shadow of cells or bacteria of interest on a chip...Through advanced signal processing tools that are running at a central computer station, the unique texture of these cell/bacteria holograms will enable highly specific and accurate medical diagnostics to be performed even in resource-poor settings by utilizing the existing wireless networks."[46]

The Health at Home/Kenya Impact Initiative

An important initiative in western Kenya is in the process of moving from concept to proof of concept. 'The Health at Home/Kenya Impact Initiative' plans to provide home-based HIV/AIDS testing and counselling, TB screening and malaria bed-nets for millions who reside in a remote region with limited access to health care. It is a collaborative public-private partnership that includes members of the Global Business Coalition on HIV/AIDS, TB and Malaria (the Abbott Fund, Accenture, Bristol-Myers Squibb Foundation, CfC Stanbic Bank Kenya, The Coca Cola Company, Deutsche Post DHL, Pfizer Inc, Premier Medical Corporation, SAB Miller and Standard Chartered Bank), the Kenyan Government and PEPFAR. The project will build on the successful Kenya-based AMPATH (Academic Model Providing Access to Healthcare Program) door-to-door pilot project where HIV testing teams achieved an 80% uptake of HIV testing among those eligible. A nurse/counsellor who enters the home has a PDA and Geographic Positioning System (GPS) device to collect and enter data on family health, record test results and identify the physical location of the household for treatment, education, counselling and data collection follow-up. Data is entered into the AMPATH medical record system, the most complete and comprehensive medical data base in sub-Saharan Africa. Anyone identified as HIV-positive is immediately given an appointment for follow-up clinical care.

Should this initiative prove successful it would serve as a model for replication in other similar areas of Africa. It also represents an example of usually competing groups working together to harness the benefits of mobile technology for a social good.[47]

Ways forward

It is perhaps this latter element that distinguishes the promise of mobile technology for improved health care in resource-limited countries from past and continuing efforts in the field of development and health care. Creative and innovative partnerships have been formed among groups who would perhaps under usual circumstances compete and who are now engaged in finding win-win solutions. There is recognition of how valuable time and resources have been squandered over the past decades in needless repetition and re-invention of the wheel or turf wars.

It is in this spirit that the UNF-VF Partnership was formed, to establish a unified global body to promote best practices and commonly agreed standards for eHealth, known as the mHealth Alliance.

An opportunity exists, described by Karl Brown of the Rockefeller Foundation in New York, a founding partner of the UNF-VF Partnership as 'smart globalization' where, as exemplified in the Mekong Basin Disease Surveillance Network, "people with different skills, speaking different languages, and reporting to different hierarchies now enjoy new ways of working together on shared information communication technology platforms".[48]

InSTEDD (Innovative Support to Emergencies, Diseases and Disasters), a not-for-profit based in the US, headed by Eric Rasmussen, exemplifies this approach. They are currently developing open-source communication solutions that can be adapted to local needs. For example, the belief is that for a global surveillance system to be effective it must "provide the people closest to the trouble with the information and authority they need to act swiftly."[49,50] They have created an open-source application that pulls together data from different mobile sources combining them with maps and other data sources allowing health workers in the field to act on a warning of a disease outbreak.

The case studies, cited above, while not exhaustive, exhibit basic characteristics that make these pilot projects a success. They demonstrate, albeit on a small scale, improved healthcare delivery as well as increased efficiency of healthcare systems. They present a foundation for future best practices. Common characteristics include:

- A clear programme with well-articulated and realistic goals and objectives reflecting both the needs on the ground and of the intended beneficiaries
- The needs must drive the technology, not the technology drive the needs. Solutions must be appropriate and responsive to local needs. The visible face of mobile technology needs to be simple and user-friendly, while the hidden back-end requires sophisticated hardware and software
- End-users must be involved from concept to completion and beyond; use of mobile technology must be incorporated into daily use and not be viewed as a burden or handicap; incentives in the form of time/cost savings and/or added prestige are important
- Ease and familiarity of use; trainings should be an integral and ongoing activity
- Engaging government at the outset is essential to sustainability

While there is a proliferation of 'mobile technology solutions', many have not moved from the concept stage. One example is the Council on Foreign Relations' 'doc in a box' – first promoted in 2005.[51] It is a standard cargo container set up to serve as a basic mobile rural health clinic and would be linked to medical professionals via mobile phone. One factor that is perhaps delaying its piloting, even though it is creative and does appear to address the issues that beleaguer healthcare workers in remote areas in resource-poor countries, is that it was developed in the west and would appear to be a developed world solution for a resource-poor problem.

If the real potential that mobile technology offers to help meet the MDG health targets is to be realised, then key to moving forward is investment in the compilation of solid evidence-based information by way of impact assessments in addition to sharing of knowledge and resources. The mHealth Alliance, an important partnership, aims to foster and meet these objectives.

References

[1] Thwaites C, UN Foundation/Vodafone Foundation Partnership, AIDS 2031: Introduction and Adoption of HIV/AIDS Technologies, slide presentation, Washington DC, April 2009.
[2] Morris K, Mobile Phones connecting efforts to tackle infectious disease, Newsdesk, The Lancet, vol. 9, May 2009. www.thelancet.com/infections
[3] World Health Organization, WHA58.28 e-health, Geneva: WHO, 2005.
[4] Lester R and Karanja S, Mobile Phones: exceptional tools for HIV/AIDS, health and crisis management, The Lancet, vol. 8, issue 12, pp 738-739, December 2008.
[5] Elder L and Clarke M, Experience and Lessons Learnt from telemedicine projects supported by IDRC in Telehealth and the Developing World, IDRC, March 2009.
[6] Dzenowagis J, Bridging the digital divide: linking health and ICT in Telemedicine and the Developing World, IDRC, March 2009.
[7] Greenberg Quinlan Rosner, A Survey of NGO Use of Mobile Technology for Social Change, Wireless Technology for Social Change: trends in NGO mobile use www.unfoundation.org
[8] Bridges.org, Real Access/Real Impact Criteria www.bridges.org/Real_Access
[9] Wireless Technology for Social Change: trends in NGO mobile use www.unfoundation.org
[10] Telehealth in the Developing World, International Development and Research Center (IDRC), March 2009 http://www.idrc.ca/
[11] Op cit. Thwaites C (2009)
[12] Op cit. Telehealth in the Developing World (2009)
[13] Benjamin P, Cell-Life: An Investigation into the Use of Cellphones for mass messaging and services for HIV Prevention and Care, Abstract 462, 4th South African AIDS Conference, Durban, April 2009.
[14] Op cit. Wireless Technology for Social Change
[15] Iluyemi A, Community-based health workers in developing countries and the role of m-health in Telehealth and the Developing World, IDRC, March 2009.
[16] Skinner D et al. Evaluation of use of cellphone to aid compliance with drug therapy for HIV patients. AIDS Care 19: 605-7, 2009.
[17] Op cit. Iluyemi A (2009)
[18] Hodes R, Encouraging ART Adherence and Treatment Literacy through Cell Phone "SMS" Messaging, Late Breaker 11, 4th South African AIDS Conference, Durban, April 2009.
[19] Op cit. Thwaites C (2009)
[20] The Economist, A doctor in your pocket, Medicine goes digital, April 18, 2009 www.economist.com
[21] Pop!Tech www.poptech.org/project_m_the_solution/
[22] Op cit. Thwaites C (2009)
[23] Praekelt G et al. Txt Alert: improving Clinic attendance through use of text message visit reminders, 4th SA AIDS Conference, LB Abstract 19, April 2009.
[24] Op cit. Pop!Tech
[25] Op cit. The Economist
[26] PlusNews: Using mobile phones to fight HIV www.plusnews.org
[27] Op cit. Thwaites (2009)
[28] Nesbit J, HIV/AIDS Care Projects and Perspectives on Global Health www.jopsa.org
[29] ibid
[30] http://medic.frontlinesms.com/#
[31] Op cit. Nesbit J
[32] Nesbit, J ibid

[33] Johnson B, Free text messages save lives in Malawi, http://www.guardian.co.uk/ 27 march 2009
[34] Op cit. The Economist
[35] Op cit. Lucky Gunasekara of FrontlineSMS:Medic in Johnson B (2009)
[36] Op cit. Wireless Technology for Social Change
[37] Op cit. Iluyemi A (2009)
[38] UHIN Technical report 2004 submitted to IDRC http://www.healthnet.org/idrcreport.html
[39] AED-Satellife www.aed.org
[40] Op cit. Wireless Technology for Social Change
[41] http://www.hivimplementers.org/2007/agenda/pdf/A3/A3%20Phones%20for%20Health.ppt.pdf
[42] http://2006-2009.pepfar.gov/press/80471.htm
[43] http://www.globaldevelopmentcommons.net/node/151
[44] http://blumcenter.berkeley.edu/telemicroscopy-disease-diagnosis
[45] http://www.economist.com/science/displaystory.cfm?story_id=11367989
[46] http://www.vodafone-us.com/web%20innovation/about_winners_cellphone.html
[47] Global Business Coalition on HIV/AIDS,TB and Malaria, Press Release, April 17, 2009 http://www.gbcimpact.org/itcs_node/0/0/news/1846
[48] Op cit. Morris K (2009)
[49] ibid
[50] Op cit. The Economist
[51] Council on Foreign Relations, Doc-in-a-Box, 2005 http://www.cfr.org/project/1247/docinabox_project.htm

HIV and TB in Practice

By Theo Smart

Are there indications of increased isoniazid resistance coming out of IPT programmes and studies?

Despite evidence showing that isoniazid preventive therapy (IPT) should markedly reduce TB-associated morbidity and mortality in people with HIV, many HIV programmes and healthcare providers remain reluctant to administer IPT because they fear that it could increase resistance to isoniazid (INH) among people with HIV who have active TB disease that goes undetected by symptom screening.

Reports that could further fuel the debate were presented at 'the 3I's Satellite Symposium' sponsored by the Aurum Institute for Health Research and the Consortium to Respond Effectively to the AIDS TB Epidemic (CREATE), held just prior to the 4th South African AIDS Conference (SAAC) on March 31st. Several speakers reviewed the currently available IPT data.

New findings include preliminary data on INH resistance among some of the participants taking IPT in the large Thibela TB study; further evidence on the value of chest X-rays before going onto IPT, as well as discussions of other possible ways to increase case finding of active TB.

Published reports suggest that people who develop resistance to isoniazid alone should respond to standard four-drug therapy – but IPT programmes should implement good patient follow-up systems to make certain that these cases are diagnosed, and monitored closely.

Background

At present there is very little evidence to suggest that IPT promotes drug-resistant disease, according to Professor Harry Hausler of the TB/HIV Care Association, who chaired the session on IPT at the symposium. He cited evidence from one 2006 meta-analysis that included over 18,000 people on IPT showing a slight increase in INH resistance, but the relative risk was fairly low (1.45, 95% CI 0.85-2.47).[1] However, the authors concluded that ongoing surveillance was essential because it was impossible to exclude an increase in resistance with the rollout of large-scale IPT programmes being recommended.

"If you think about ART versus IPT, 10-20% of people who are HIV-positive are eligible for antiretroviral therapy, but close to 40% of people who are HIV-positive are eligible for IPT," said Prof Hausler. "So we should be looking at 6 *million* people on IPT globally rather than 29,000 [put on IPT last year]."

To date though, aside from the Botswana IPT programme, there have yet to be many large-scale programmes delivering IPT to people with HIV in high TB burden settings.

Botswana is undertaking countrywide surveillance for TB drug resistance but those data are not yet available. According to a couple of speakers at the symposium, recent studies have not reported much IPT resistance. For instance, in the Botswana IPT trial that is running concurrently with the IPT programme, only seven out of 1995 subjects taking six months of IPT have been diagnosed with active TB "but there has been no evidence of INH resistance," Dr Tefera Agizew of Botswana's Ministry of Health said at the symposium.

Similarly, Dr Neil Martinson of the Perinatal HIV Research Unit reported that IPT did not drive resistance in a study he conducted comparing several different TB preventive therapy regimens, including two IPT arms, (IPT for six months or continuous IPT). In a report earlier this year at the Conference on Retroviruses and Opportunistic Infections, there was no resistance in 14 out of 19 TB cases that occurred in 328 patients who had received six months of isoniazid (specimens were not available for five), and only one case of MDR-TB in the seven breakthrough cases out of 164 people taking INH continuously.

Thibela TB study

Thibela TB, however, is by far the largest study of IPT to date. It is a cluster-randomised trial to measure the impact of community-wide isoniazid preventive therapy (IPT) on TB incidence at the community level, in a population with a high prevalence of HIV. In the study, entire mine-shafts, rather than individuals, have been randomised to standard TB control with or without the addition of IPT. The total study population will include around 70,000 people – with about 38,000 on IPT.

Professor Gavin Churchyard presented some of the first resistance data from the study so far (see table). The impact of IPT on resistance is most apparent among first episodes of TB with mono-INH resistance, since resistance among retreatment cases could have been acquired during prior TB treatment.

Preliminary drug susceptibility of TB on IPT

Active TB	IPT (n=66)		Comparison (n=129)	
	First episodes, n=53 % (95% CI)	Retreatment, n=13 % (95% CI)	First episodes, n=97 % (95% CI)	Retreatment, n=32 % (95% CI)
Any INH	7 13.2% (5.5-25.3)	1 7.4% (1.9-36.0)	8 8.2% (3.6-15.6)	8 25% (11.5-43.4)
MDR	1 1.9%	1 7.7%	3 3.1%	4 12.5%

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"We would expect to see a higher proportion of INH resistance in people taking IPT," said Prof Churchyard. "And although it is slightly higher in terms of INH resistance, it is not significantly higher."

Indeed, the preliminary differences do not seem to be significant. But the fact that it is higher at all is worth noting, particularly because Thibela TB has one of the most rigorous screening processes for screening out active TB – including chest X-rays. Programmes that don't do as good a job of screening for active TB before IPT may see more resistance. Furthermore, breakthrough cases were also more likely to be quickly diagnosed in Thibela, which may not be the case in the 'real world.'

Given that IPT could still cut the number of active TB cases by 30 to 50%, a slight increase in resistance is still not a good excuse to prevent roll-out of IPT. However, it does suggest that more attention should be given to optimising the screening process – to reduce the number of active TB cases that are missed – and to the management of people with breakthrough disease.

Screening for active disease

"The difficulties screening for TB in HIV-infected patients are well known," Dr Salome Charalambous of the Aurum Institute said at the symposium, and described several studies exploring optimal screening methods. Programmes should use such screens to identify people with symptoms since only 'the well' should be put on IPT. However, several studies have found that some people with HIV have no symptoms.

Dr Charalambous noted conflicting data on usefulness of chest X-rays. A pilot study for Botswana's IPT programme suggested X-rays didn't add much to screening, but representatives of the programme later reported subsequent experience that X-rays do indeed pick-up some cases of TB in asymptomatic patients. Dr Charalambous described one study in South African gold miners, where adding chest X-ray to a symptom-screening tool (night sweats, cough and weight loss) improved sensitivity from around 60 to 90%.

According to preliminary results from another study, 381 patients at Tshepong Wellness Clinic in the Northwest Province were screened for active TB prior to starting ART. TB was diagnosed in 31.6%.

"But using a symptom screen alone would miss one quarter of the TB cases, while chest radiography improved sensitivity substantially," said Dr Charalambous. "One thing I'd like to emphasize, is that [in this study] 62.5% of patients had TB symptoms, so even if we are just screening with symptoms, we would still have to further screen these patients with sputum microscopy and culture – which would lead to overstretching our laboratory facilities."

But in Thibela, even more cases would have been missed if they had relied on symptom screening alone, as more than half, 54.6% of the TB cases detected, were asymptomatic. "In our setting, X-ray detected a significant proportion of all TB," said Prof Churchyard.

Dr Martinson stressed that it was very important to exclude active disease – but he was not certain that chest X-rays would really be appropriate in the field.

"I would recommend not doing a chest X-ray. I think it's really an excuse just to keep people away from receiving isoniazid preventive treatment, especially when we consider that IPT is meant for well people," he said. "Clearly asymptomatic TB in HIV-infected individuals is a concern, but my experience is that TB is a fairly malignant disease in people who are HIV-infected. If you have at least two visits, one month apart, before giving IPT, most people who are HIV-infected who have got active TB are not going to be walking around feeling good for more than a month." However, he suggested an additional option "Anyone who is HIV-infected should have a TB culture," he said.

"Active screening with culture detects even more disease," said Dr Stephen Lawn of the Desmond Tutu HIV Centre. In another study of 235 people enrolling into the ART programme, Dr Lawn and colleagues found that 25% (n=58) had culture positive TB.[2] But in the absence of culture (specimens were sent to the lab for every participant), it would have been difficult to identify everyone with TB – 22% of those with culture positive TB had not TB symptoms (any one or more of cough, fever, night sweats or weight loss) and 30% had no sign of TB on chest X-ray.

Dr Lawn said that despite having no symptoms, it was possible to obtain induced sputum from people with HIV and get a diagnosis.

Unfortunately, in most settings, it takes weeks to get culture results back – and the capacity to do culture in everyone with HIV simply does not exist.

"We must be careful not to overstretch our laboratories, and with chest X-rays, there are also issues with access and interpretation," said Dr Charalambous.

If anything, these observations once again underscore the need for an inexpensive and highly sensitive point-of-care diagnostic.

In the meantime, programmes rolling out IPT should make certain that they have good patient follow-up mechanisms, so that active cases that are missed and breakthrough cases on IPT are detected quickly and put on effective treatment.

Managing breakthrough disease

Published data suggest standard treatment ought to work.

"When active TB occurs among those given IPT, standard four-drug first-line therapy works," said Professor Hausler citing two studies.[3,4] However, the number of patients involved in these studies was not great – and mostly they were not performed in resource-constrained settings with a high burden of HIV and without good systems for patient adherence and follow-up.

It will be especially important for programmes to closely monitor treatment in patients with mono-INH resistance, because there is a chance that less than optimal responses could lead to resistance to other TB drugs as well.

Operational plans for IPT programmes should include systems to document responses to standard TB therapy in people with HIV and INH-resistant TB. Another possibility would be to design studies to investigate what the best treatment options for these cases would be, comparing outcomes on standard therapy to those when people are given prolonged treatment, higher doses of INH (16-20 mg/kg) (several studies suggest that high doses remain active against the low level INH resistance most commonly be seen in first episodes of TB) or 5-drug regimens. In the end, more aggressive regimens may not be necessary, but it would be prudent to start asking these questions sooner than later.

Reviewers

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References

[1] Balcells ME et al. Isoniazid preventive therapy and risk for resistant tuberculosis. Emerg Infect Dis May;12(5):744-51, 2006.
[2] Edwards D et al. Baseline Screening for TB among Patients Enrolling in an ART Service in South Africa. 16th Conference on Retroviruses and Opportunistic Infections, Montreal, abstract 780, 2009.

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[3] Mitchison DA, Nunn AJ. Influence of initial drug resistance on the response to short-course chemotherapy of pulmonary tuberculosis. Am Rev Respir Dis Mar;133(3):423-30, 1986.

[4] Nolan CM, Goldberg SV. Treatment of isoniazid-resistant tuberculosis with isoniazid, rifampin, ethambutol, and pyrazinamide for 6 months. Int J Tuberc Lung Dis, Nov;6(11):952-8, 2002.

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