Text messages could hasten tuberculosis drug compliance

Eliza Barclay

Available online 1 January 2009.

Mobile phone technologies are being harnessed to help patients with tuberculosis keep up with their treatment regimens, with some promising preliminary results. Eliza Barclay reports.

A handful of new technologies designed to connect tuberculosis patients with their caregivers using text messaging, or SMS (short message service), hold potential for helping to improve adherence to gruelling drug regimens.

The treatment for tuberculosis is a combination of strong antibiotics that must be taken daily for at least 6 months. But side-effects, such as nausea and heartburn, dissuade some patients from sticking with the treatment. Other patients endure the side-effects only to drop the medication once they feel better 1 or 2 months into the regimen. The Stop TB Partnership reports that on average 5% of tuberculosis patients abandon treatment, although the figure is as high as 20% in some countries.

Those patients who cannot or do not adhere to the treatment remain infectious longer and are more likely to relapse and die. They are also vulnerable to developing multidrug-resistant tuberculosis, a strain resistant to two or more first-line drugs, or extensively drug-resistant tuberculosis, a strain resistant to three or more second-line drugs.

To help people complete their treatment WHO recommends a strategy known as DOTS (directly observed treatment, short course). As part of this strategy, a health worker or a tuberculosis treatment supporter watches the patient take their antibiotics every day. Patients also receive counselling and support to ensure they do not stray from their treatment course.

Although DOTS has helped to dramatically improve tuberculosis control around the world, it is insufficient or inaccessible for thousands of patients. Many seek treatment in private clinics without close monitoring from their doctor. “Patients that most often fall through the cracks are usually the ones that first [go] to private clinics”, said Aamir Khan, the executive director of Interactive Research and Development in Karachi, Pakistan and a faculty member at Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA. “While the DOTS programme is not perfect, my experience is that there are many more patients in the private sector that have been mismanaged and abused by unscrupulous health practitioners.” Khan noted that private doctors often overprescribe. He
has seen patients taking nine expensive antibiotics when only four are required.

Other experts note that DOTS is expensive and human-resource intensive. They say it is unrealistic to expect health workers to monitor patients on a daily basis.

Several disease control and technology specialists are now looking to SMS as a cost-effective way to communicate with and monitor hard-to-reach patients in remote locations. “The problem is enormous, and everything has to be done in order to prevent patients from defaulting”, said Mario Raviglione, director of WHO's Stop TB Department. “Anything that can be done technologically to help solve this issue like these cellphone technologies would be useful.”

Although tuberculosis is a disease affecting poor people, even those living on US$1 per day increasingly have access to mobile phones. There are more than 3-3 billion mobile-phone subscriptions worldwide. By the end of 2006, according to the International Telecommunications Union, 68% of those subscriptions were in developing countries.

South Africa has proven a fertile testing ground for new drug-compliance technologies. According to WHO, South Africa had a 71% DOTS treatment success rate in 2005; most patients who were not successfully treated under DOTS defaulted on their treatment.

Several companies have addressed the compliance problem by developing devices that remind patients to take their medication, and feature back-up links to health workers, friends, or family members if the patient fails to respond to the first reminder.

High-quality image (321K)
A mobile phone owner in Khayelitsha, one of the poorest townships in South Africa

Getty Images
One reminder product is a small pill bottle made by London-based SIMpill that contains a SIM card and when opened, the SIM card delivers a SMS with a unique pill box identification number to a central server. The central server receives the incoming SMS and stores the data, but if no SMS is received at the designated time, the server contacts the patient via phone alerting them to take their medication. If the patient does not respond, the server contacts a caregiver who can follow-up with the patient.

From July, 2006, to April, 2007, SIMpill did a pilot study in 155 tuberculosis patients at three clinics in the Cape Town area with the Western Cape Department of Health. After patients used the SIMpill for 10 months, drug adherence stabilised between 86–92% with a treatment success rate of 94%, according to SIMpill.

Ann-Mari Albertsen, managing director of SIMpill, says, in addition to helping patients adhere to their treatment, SIMpill also frees up health workers from daily observation of patients taking their medication. Albertsen noted that with SIMpill, a nurse could keep tabs on 50–60 patients rather than just ten patients. “We see staff focusing on other parts of their job, like counselling, training, and actual follow-up with patients who need more attention, instead of keeping up with tablets and glass of water”, said Albertsen.

Albertsen would not reveal the cost of the technology but says the company is signing a contract with a major international public-health organisation working in South Africa, which plans to deploy the product on a larger scale.

SIMmed, developed by CompuTainer, is a direct competitor of SIMpill in South Africa, and claims to be a less expensive and equally effective product. Instead of monitoring patients through a pill bottle, SIMmed asks patients to press the speed dial button on their mobile phone after taking their medication. The number dials into a server, which records the medication event, and reminds the patient by SMS or contacts a caregiver if the patient fails to call.

The first SIMmed trial in Khayelitsha, South Africa, yielded a compliance rate of over 90%. CompuTainer is now working with the South African Government to reach 45 000 new patients with the programme.

Other groups are using SMS messaging in combination with economic incentives to improve treatment adherence. X out TB is an SMS-based system invented by a group of scientists and entrepreneurs with the Innovations for International Health project at the Massachusetts Institute of Technology, Cambridge, MA, USA.

Each day after taking their medication, tuberculosis patients urinate on a filter paper diagnostic, which detects the metabolites of the first-line tuberculosis drug isoniazid and reveals a code. The patient sends the code over SMS where it is stored on a server. Based on accumulated right answers (correct codes) at the end of the month, patients receive
rewards. In the first trial in Nicaragua, patients received $2 worth of mobile phone minutes each month. “We are concerned people just don't behave rationally in conditions like DOTS”, said Jose Gomez-Marquez, programme director of Innovations for International Health. “If they can shortcut something, they'll do it. But if there's an economic reward involved, there's a bigger incentive to follow the rules of the programme.”

In the next X out TB trial in Pakistan, Khan will target patients attending DOTS clinics. He said X out TB would like to compare compliance between the routine DOTS programme and one with X out TB integrated into it.

However, some experts question whether SMS technologies will effectively replace thorough face-to-face monitoring from a community health worker. Partners in Health (PIH), a Boston-based non-profit organisation, working in several of the poorest developing countries has developed one of the most effective programmes for tuberculosis treatment using community health workers. Every day, the workers visit patients in their homes to supervise treatment. PIH also developed DOTS Plus, a regimen for treating multidrug-resistant tuberculosis, where patients receive daily nutritional support as a supplement and incentive for treatment.

According to Hamish Fraser, director of informatics and telemedicine for PIH and assistant professor at Harvard Medical School, the success of PIH's programmes without the use of SMS communication indicate that SMS-based health technologies may be unnecessary. “I think in developing countries, having a DOTS worker visit patient in their home is extremely effective”, said Fraser. “We don't immediately feel there's a big gap there so I'm less sold on cellphones.”

Raviglione, however, believes that SMS health technologies could have a role in improving communication in tuberculosis treatment and care. “Though the human aspect of tuberculosis care and control must not be forgotten or underemphasised, there's always great value in increasing communication between the patients and the clinicians”, he said.