

External Research Digital Inclusion Program

## HIV/AIDS Information System Taps Cell Phone Texting Capabilities

*The HIV/AIDS epidemic has devastated communities throughout sub-Saharan Africa, which comprises just 11 percent of the world's population but 63 percent of those currently living with this condition. There are an estimated 12 million AIDS orphans—children who have lost at least one parent to the disease—in the region. Here is how one group of researchers is using mobile phone technology to create a unique system for delivering HIV/AIDS prevention and treatment information to the people who need it most.*

Botswana is among the countries hardest hit by HIV/AIDS, with an estimated 270,000 of its people—including nearly one in four adults—infected with the illness. Medical experts widely agree that battling this epidemic requires a multi-faceted approach that includes providing people with accurate information about HIV/AIDS prevention and treatment in addition to delivering clinical care.

Yet many of Botswana's people, the Batswana, remain ill-informed about the causes of the disease and how to manage it. One obstacle to making such information more broadly available is that much of the country's population—particularly those who are poor and illiterate or semiliterate—have little or no access to the Internet, which can offer ready sources of up-to-date information.



*Computer scientists at the University of Botswana are leveraging the widespread adoption of mobile phones throughout sub-Saharan Africa to create a text message-based medical information system that can raise the timeliness and overall quality of patient care, particularly for those with HIV/AIDS.*

### Fast Facts

**Project:** Integrated Health Information System through Mobile Telephony (IHISM)

**Project Principal:**  
Prof. Henry Nyongesa,  
University of Botswana

**Partners:**  
Botswana National Call Centre on HIV/AIDS, Botswana-Baylor Children's Clinical Centre of Excellence

**Profile:**  
University of Botswana researchers are developing an Internet-based health care information service that can process text-message queries from cell phone users and deliver relevant information about how to self-manage chronic health conditions such as HIV/AIDS. The service will also allow health workers to look up patient records and monitor follow-up care between office visits, resulting in better treatment and lower health care costs.

### Digital Inclusion Program

The Microsoft Research Digital Inclusion Program provided US\$1.2 million in research funding in 2006 to empower academic researchers worldwide to tackle technological challenges that could positively affect health, education and socioeconomic conditions. The 17 recipients, selected from among 162 proposals from 34 countries, received technology resources as well as project funding.

The Digital Inclusion Program is administered by the External Research group within Microsoft Research and is part of the group's ongoing commitment to investing deeply in innovative research. The External Research group collaborates with the world's foremost researchers in academia, industry and government to move research in new directions across nearly every field of computer science, engineering and general science.

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*Using the text-message capabilities of mobile phones to deliver medical information can greatly increase HIV/AIDS awareness and prevention, especially in underprivileged communities.*

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—Henry Nyongesa,  
professor of computer science  
at the University of Botswana

A team of computer scientists at the University of Botswana, led by Professor Henry Nyongesa, is working to overcome this problem by capitalizing on a device that is already in the hands of most young adults in Botswana: the cell phone. With funding from the Microsoft Research Digital Inclusion Program, Nyongesa's team is developing an Internet-based healthcare information service that accepts text-based inquiries from common wireless devices and responds with personalized information about how to effectively prevent and manage chronic health conditions such as HIV/AIDS. This information service, named Integrated Health Information System through Mobile Telephony (IHISM), will offer clinic health workers a reliable and efficient way to obtain information about patients and monitor their follow-up care between visits, resulting in better treatment and lower health care costs.

“Wireless phones have rapidly grown into the main form of telecommunication in Botswana,” says Nyongesa, who heads the computer science department at the University of Botswana, located in Gaborone. While landline telephone service in many parts of the country is poor, one in two adults has access to a cell phone, and reliable wireless network coverage across Botswana is at roughly 80 percent and growing.

“We believe that using the text-message capabilities of mobile phones to deliver medical information can greatly increase HIV/AIDS awareness and prevention, especially in underprivileged communities,” he says. “Particularly in regions like sub-Saharan Africa, where computer literacy is still very low, mobile telephony also represents the most promising solution for allowing more people to access the benefits of the digital age.”

Thanks largely to government initiatives such as no-cost antiretroviral (ARV) drug treatment for patients and a campaign to prevent mother-to-child transmission of HIV, AIDS-related deaths and new cases of HIV/

AIDS have been decreasing in Botswana in recent years. However, massive stigma is still attached to HIV/AIDS throughout Botswana and the rest of sub-Saharan Africa, which makes many people reluctant to be tested.

“Discrimination against those with HIV and AIDS, together with a high level of illiteracy, has contributed to widespread ignorance and fear of the disease,” says Nyongesa. “Particularly in rural communities, many Batswana lack basic information about hygiene and preventive care and about what treatment options are available if they do fall ill.”

Another challenge to providing effective long-term care in Botswana is that people frequently move between villages, so health workers often don't have access to a patient's medical history and may not see the person again for months—if ever. To address these challenges, Nyongesa's team has focused on cell phones and Short Message Service (SMS) text messaging as key elements of the health information service. In a country of roughly 1.7 million people, more than 700,000 use cell phones. Predominantly, they are young Batswana between the ages of 14 and 45, who regularly use text messages to communicate with friends and family.

Special software installed on the cell phone will allow a user to log in to the IHISM system and send text messages to a central database server containing answers to frequently asked questions about HIV/AIDS, such as “What are antiretroviral drugs?” or “Are children eligible for therapy?” A search agent application running on top of a Microsoft® SQL Server™ database will analyze the SMS message, select the most relevant content from the repository, and package it into a text message reply.

Nyongesa says his team is also developing Web-based “intelligent personal information center” applications that allow individuals to share information about themselves, which the IHISM system can analyze. This voluntary information will help the

service to more accurately answer people's questions as well as provide other useful resources. For example, the system will keep a record of a user's medical history, past inquiries and other personal details so that each time he or she submits a new request for information, the software can apply a series of computational algorithms to filter out redundant or irrelevant data before sending a response.

As this knowledge repository expands, Nyongesa predicts that the system will also become a valuable tool for physicians, other healthcare professionals, and scientific researchers. Potential uses include checking and updating patient records, staying informed about the latest research findings, and gathering anonymous demographic data about the prevalence and spread of chronic diseases to help organizations develop more effective treatment and prevention strategies.

"These types of two-way interactions between doctors and patients will not only raise the timeliness and overall quality of individual care," says Nyongesa, "but will also help create a more comprehensive and accurate picture of how the whole HIV/AIDS epidemic is unfolding—especially in remote areas that are difficult for health care workers to reach."

Since text messages commonly include abbreviations such as "l8r" for "later" and "r" for "are," one of the biggest design challenges for the IHISM team is to make sure the system can infer the correct meaning of this so-called "natural language" parlance. Also, since both Setswana, the predominant national language, and English are widely used in Botswana, the software must be capable of interpreting—or parsing—messages in either language as well as a mixture of the two.

One of the team's first steps toward addressing these requirements involved having two groups of 20 bilingual students at the University of Botswana rewrite a series of

HIV/AIDS-related questions using text-message-friendly abbreviations and terms. The process of identifying the most frequently used keywords and their variations within truncated questions—such as "Wat r advs of ARV trtmnt" and "Wht r advntg of ant-retrvrl treatment"—and programming them into the IHISM system's bilingual natural language parser software will help yield a service that can meet the needs of people with low literacy skills and diverse communication styles.

The research team also plans to incorporate graphical icons into the system to help reduce the amount of text that users have to read on a small cell phone screen. This will also enable medical providers to better communicate with illiterate users. For example, a clinic could send patients an automated message with a picture of a pill to remind them to take their medicine or send a drawing of a stethoscope on the morning of their next doctor's appointment. These types of reminders will also benefit patients who rarely meet face-to-face with their primary physician, either because they live in a remote area or because they relocate often.

Nyongesa and his colleagues are currently working with Botswana's national HIV/AIDS informational call center and selected medical and humanitarian aid organizations to build the IHISM document repository. He hopes to have a prototype IHISM service ready for field testing among patients and health workers within the next two years.

The government of Botswana has set an ambitious goal to end the spreading of HIV in the country by 2016. Nyongesa believes that harnessing the affordability, simplicity and popularity of cell phones can be a powerful catalyst in this effort. "It's exciting to work with technology that is broadly available to users with limited incomes and skills but is also capable of delivering information that can empower them to make better choices about their health," he says.

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