

# THE FUTURE IS NOW

## MOBILE TECHNOLOGY AND PUBLIC HEALTH

TEXT AND PHOTOGRAPHY BY ANANT SHAH



**T**wenty-five years ago, the US Centers for Disease Control and Prevention (CDC) first reported cases of *Pneumocystis carinii* pneumonia, the disease that would later be known as AIDS. That same year, the IBM Corporation launched the personal computer. The shared anniversary of these historic events is not trivial; personal computing has had a profound impact on public health in the last quarter century.

There are countless examples, all invaluable to public health. Personal computers created a standard, globally adopted architecture for hardware and software, enabling, for example, the advent of powerful analytic and statistical tools that can be used on laptops in the field. They provided for cheap, instant, worldwide communication, by which disease outbreak alerts can be sent instantaneously via email. And PCs empowered people

to become informed consumers through easy-to-access health information on the Internet. Given how far we have come, what is the future of the partnership between personal computing and public health, especially when information needs to be collected, analyzed, and communicated in the poorest- and hardest-to-reach communities on the planet?

In Kenya, two projects demonstrate how modern personal computers are shaping the future of public health practice. The CDC's International Emerging Infections Program is experimenting to improve Kenya's capacity to detect, prevent, and control disease. Call it public health meets mobile technology. Call it public health pushing the envelope. Or simply, call it the future.

A recent issue of *The Economist* notes that although PCs "encourage innovation," they are too "bulky, expen-

sive, and energy-hungry” for the developing world. To truly meet the potential of digital technology and extend its benefits to everyone on the planet, “the PC may not be the best tool for the job.” But if not the PC, then what? Perhaps those same tiny gadgets we keep stuffed in our pockets and backpacks – personal digital assistants (PDAs) and mobile phones.

Imagine if you could interview a family about their health, enter the information into a PDA, and sync the data wirelessly to a database in an office miles away, ready for real-time analysis – all while sitting in the middle of one of Africa’s largest slums where homes are made of mud and open sewage lines the walkways. Or imagine if you could deliver health alerts with text messages to tribal chiefs across rural Africa who do not have Internet access but do own a \$20 mobile phone. And that same chief could send a text message to report a suspect case of a dangerous infectious disease to health authorities using the same \$20 phone.

These scenarios are neither far-fetched nor imaginary. CDC and Kenya’s Ministry of Health (MOH) are using PDAs and cell phones in unprecedented ways.

The first is a surveillance project established in collaboration with Carolina for Kibera (CFK), a non-profit organization run by the University of North Carolina

at Chapel Hill. Among other things, CFK runs an acute healthcare clinic in the slum of Kibera, in Nairobi. With over one hundred patients each day, the clinic is a ripe source of otherwise unavailable health information. In partnership with CFK, the CDC launched a “Household Morbidity Surveillance Study” to identify the sources and burden of various diseases affecting the slum community. Ultimately, these findings will direct public health interventions that meet the specific needs of Kibera. The study includes more than 20,000 residents who are interviewed twice a month about symptoms and exposures specific to various respiratory and gastrointestinal diseases. The program requires twenty-five Swahili-speaking “community interviewers,” each of whom visits and interviews twenty families every day.

Using paper, interviewers must take time to handwrite answers, carry stacks of forms between the field and the office, and rely on separate data entry staff to interpret and transfer data from the paper to a database. Conducting interviews requires extensive training. When data is incomplete because of an error in the interview, whether it is incorrect nomenclature or a wrong question, workers must return to the field to repeat it.

Enter the PDA. The formerly cumbersome process of collecting, storing, transferring, and entering data be-



comes a simple automated step. With an electronic survey loaded onto a PDA, the correct sequence of questions appears and data are synchronized without additional data entry staff. The field worker need not carry more than a six-ounce device. According to the manager of the study's data, Joseph Musyimi, the benefits are significant: "PDA data quality is higher than paper data because of the ability to force data validation and skip routines in the field. Data collection-to-analysis time is reduced because your field staff becomes your data entry staff. PDA data collection is cheaper because there are no printing and paper costs and no data entry staff costs."

Admittedly, the use of PDAs juxtaposes modern technology against poor and rural communities that lack the most fundamental, everyday needs, such as clean water. Kibera is one of the world's largest and poorest slums, 600 acres containing one million people with an estimated per capita income of twenty cents. Despite the need for even the most basic public health interventions, the use of cutting-edge technology is still important and relevant. It can be leveraged to perform innovative research and ultimately better protect people's health living under abject conditions.

## SMS technology could be a model to improve health communication worldwide. If CNN, ESPN, and American Idol can use such technology to communicate and analyze information, why can't public health?

Beatrice Olack, the project's coordinator, describes using PDAs to perform epidemiology and surveillance in Kibera as "an amazing discovery" where mobility combined with greater attention to privacy and improved data integrity leaves the "future of scientific research in rural Africa bright."

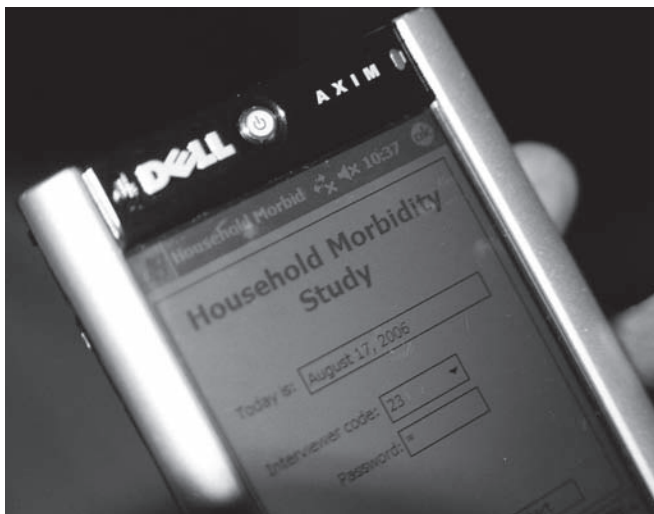
Bright indeed. In addition to research, the common cell phone empowers rural communities to communicate health information without telephone lines, computers, fax machines, or Internet.

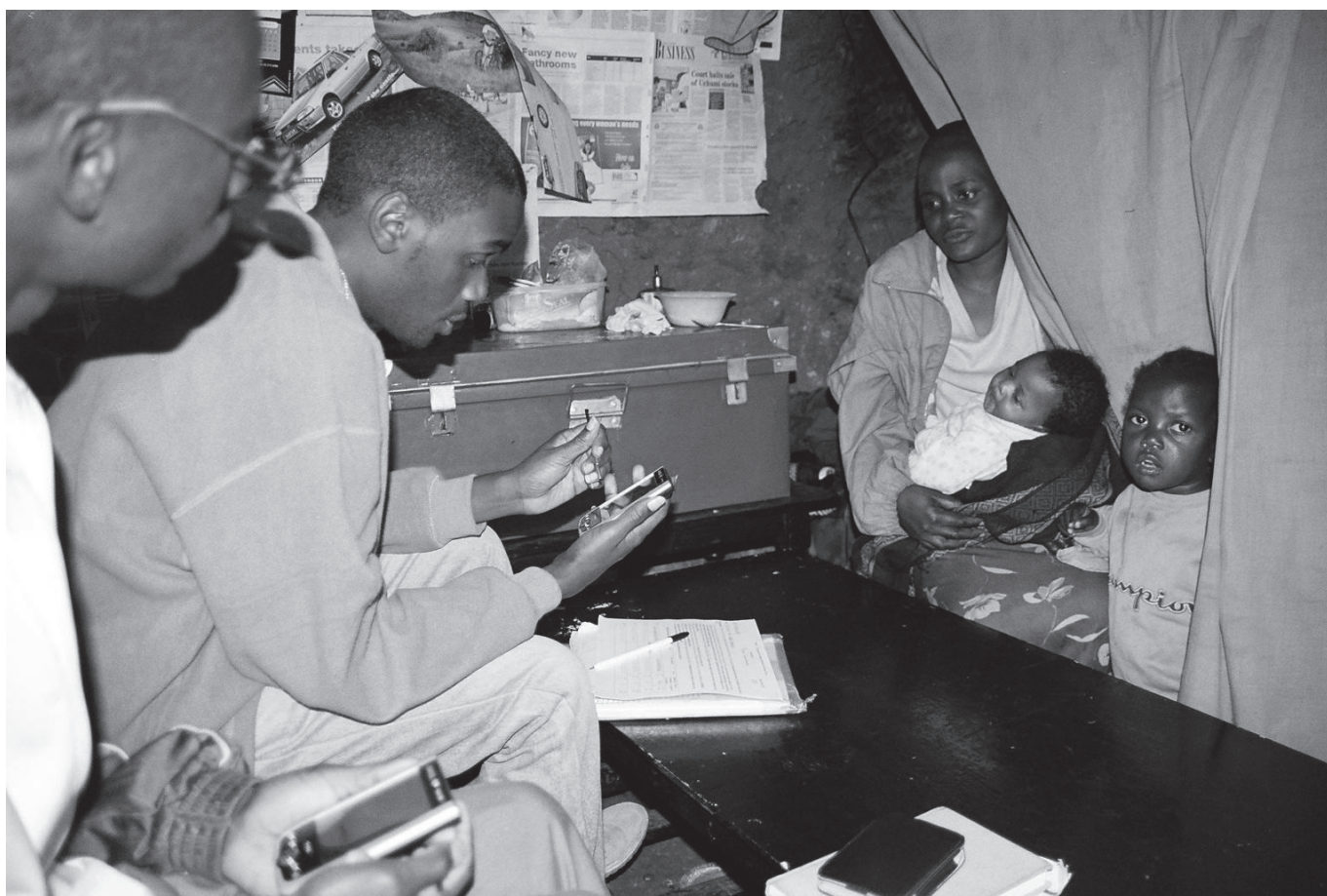
Why the mobile phone instead of the conventional computer and Internet? Cell phones are simply cheaper and more accessible. In a popular advertisement, Safaricom, Kenya's leading mobile phone service provider, captures the accessibility of this technology. A Masai warrior, dressed in the famous Masai red blanket, stands in the middle of a vast plain holding a walking staff in one hand and a mobile phone in the other. Hardly an exaggeration, this anachronistic image is an increasingly common occurrence in Kenya.



With a per capita income of \$1,200, many Kenyans cannot afford computers, much less reliable Internet access. But Kenya has readily adopted the cell phone. The Central Bank of Kenya estimates that there are 6.5 million mobile phone subscribers in a national population of 34 million. There are nearly 100,000 new subscribers each month. In comparison, a 2000 report from the African Internet and Telecom Summit estimated that there were only 50,000 Internet subscribers, with a growth rate of 300 per month. In fact, Safaricom became the country's most profitable company in March 2006, making \$170 million in profit, a forty-five percent increase from the previous year. Mobile phones have dwarfed the Internet and therefore have tremendous potential to improve health communication and surveillance across Kenya.

To tap this potential, the CDC and the MOH have launched a second project exploring text messaging as a means of conducting disease surveillance and health communication. Given that eight African countries have confirmed cases of avian flu in animals and two neighbors of Kenya, Djibouti and Egypt, have confirmed human cases, a potential pandemic demands robust surveillance capacity. But flu or no flu, the ability to send and receive





messages, especially in rural areas or refugee camps, allows for early detection and response to many dangerous infectious diseases like TB, SARS, and Ebola.

CDC and the MOH are working to design automated systems that use short message service (SMS), the technical term for text messaging, for surveillance, outbreak updates and alerts, training, and delivering health messages to the public.

All four improve public health practice in different ways. In surveillance, an automated system collects or disseminates information using programs designed for specific diseases. A rural community health worker could send a text message with pre-established codes, each of which signifies a fixed message. For example, the message 1234 might denote a suspected case of avian flu. The central system would automatically send necessary follow-up questions as well as store and analyze the answers in a central database. Ultimately, such a system would allow community leaders in remote areas with little or no land phone or Internet access to alert health authorities of potential outbreaks.

Second, the automated system would allow authorities to send health updates and urgent outbreak alerts to multiple people in multiple locations simultaneously. Such alerts can quickly trigger disease prevention actions in the field. Third, simple instructions to train and assist healthcare workers in the field could be sent through SMS technology. For example, free texts between experts and healthcare workers in the field might allow them to prop-

erly handle a chicken suspected to have avian flu or even treat a patient with suspect symptoms.

Finally, SMS technology allows “blast messages,” customized health warnings that can be delivered to a large group of people in different locations. These messages, for instance, might inform the general public to avoid certain foods or areas under quarantine.

Though still in the early stages of development, SMS communication and surveillance holds promise. As it is refined, it may not only improve health communications across Kenya and East Africa but could also be a model to improve health communication worldwide using cheap, accessible technology. If CNN, ESPN, and American Idol can use such technology to communicate and analyze information, why can't public health?

Perhaps *The Economist* is correct when it argues that it is not the PC, but the “mobile phone that now seems most likely to carry the dream of the ‘personal computer’ to its conclusion.” Whether it is the mobile phone, PDA, or something else entirely, no one can say for certain. But one thing is for sure; mobile technology has pushed public health to the verge of revolution. It is the future.

---

*Anant C. Shah is a Master of Public Health candidate in Epidemiology of Microbial Diseases at the Yale School of Public Health and concurrently works for the CDC.*