

Cell Phone Technology Can Help Bring Better Health in Africa

Pneumonia is one of the world's leading killers, yet it is often misdiagnosed and improperly treated due to its similarity to other febrile illnesses. Researchers at the University of Melbourne in Australia are exploiting the ubiquity of cell phones by adapting them to help health workers in the developing world diagnose pneumonia and perform other critical tasks.

Working as a physician in war-torn Mozambique in the late 1980s, Jim Black once crafted a crude calculator out of cardboard circles and tacked it up on the wall of a village clinic. The purpose of the makeshift calculator was to help local health workers translate the traditional lunar method of estimating a woman's stage of pregnancy into a more precise measure of fetal development.

Taking that same approach—focusing first on a health need and then adapting available, inexpensive technology to solve the problem—Black and his colleagues at the University of Melbourne in Australia are using Microsoft technology to develop a suite of smartphone-based applications for use by health workers. These include searchable drug formularies, diagnostic and treatment manuals, and tools to calculate pulse, respiratory rate and proper drug dosages. But furthest along, and perhaps of greatest potential significance, is a tool aimed at one of the world's biggest killers: pneumonia.

Worldwide, pneumonia kills at least 2 million people each year, many of them children in Africa. Sadly, many of these deaths could be avoided if the disease were properly diagnosed and treated.



Researchers at the University of Melbourne have developed a prototype device that will allow health workers in Mozambique to use their mobile phones to better diagnose and treat pneumonia and other health issues.

Fast Facts

Project Principals:

Jim Black, associate professor, Nossal Institute for Global Health, University of Melbourne

Rens Scheepers, associate professor, Department of Information Systems, University of Melbourne

Liz Sonenberg, professor, Department of Information Systems, University of Melbourne

Web Site:

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Profile:

Researchers in public health and information systems at the University of Melbourne, in collaboration with Mozambican physicians and health workers, are using Microsoft technology to develop a suite of inexpensive and easy-to-use mobile phone applications that can help health workers in developing countries diagnose disease and improve care.

Microsoft External Research

The Microsoft External Research Division within Microsoft Research partners with academia, government and industry to advance computer science, education and scientific research aimed at helping address some of the world's most urgent and significant social and technological challenges. Along with investing cash, software, hardware and research expertise to enable ground-breaking projects worldwide, Microsoft External Research is committed to providing the advanced technologies and services needed to support every stage of the research process. Efforts are focused in four research areas—including Health and Wellbeing, which explores technologies that advance healthcare and help people make better choices about their health.

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<http://research.microsoft.com/en-us/collaboration/>

"It's surprisingly hard to diagnose and distinguish pneumonia from other febrile illnesses," says Black, an associate professor at the University of Melbourne's Nossal Institute for Global Health.

In a modern hospital setting, physicians can use chest X-rays, lab tests, blood oxygen measurements and other diagnostic tools to distinguish between the many causes of respiratory illness. In a remote African village, few such tools are available to determine if a child's fever and shortness of breath are caused by pneumonia, malaria or some other infectious disease. However, most health workers in Mozambique do carry cell phones. So with financial, software and hardware support from Microsoft External Research, Black and his colleagues in Melbourne have developed an inexpensive smartphone-powered "oximeter" that they believe can give health workers a front-line tool in the battle against pneumonia.

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**Jim Black, associate professor,
University of Melbourne**



An oximeter measures the oxygen content in red blood cells by measuring the absorption of red and infrared light waves as they pass through a patient's fingertip or ear lobe. Hemoglobin, the oxygen-carrying component of blood, is often in a depleted state in people with severe pneumonia.

"It just so happens that the light wavelengths used in oximeters are the same wavelengths used in an optical mouse or a TV remote control," says Black. As a result, the LEDs (light-emitting diodes) needed for an oximeter sensor are widely available and inexpensive.

Working with information science experts Liz Sonenberg and Rens Scheepers at the University of Melbourne, along with colleagues in engineering and medicine, Black has created a prototype US\$10 oximeter sensor that Mozambican health workers can simply plug into their mobile phone. Working with Microsoft® Visual C#® and .NET Framework development tools, the Australian team has created software that can be installed on smartphones to analyze the varying oximeter wavelength readings obtained from the inexpensive LED fingertip sensor.

In collaboration with medical faculty at the Eduardo Mondlane University in Maputo, Black intends to begin a technical evaluation of the prototype in Mozambique, with clinical trials in Melbourne. If the approach with smartphones proves successful, the team will focus on expanding its use to simpler cell phones, he says.

"Once we can show that this works and is popular with front-line health workers, we intend to publish the plans on how these things can be made," Black says. The long-term goal is to entice an instrument manufacturer to commercialize an inexpensive cell phone oximeter and make it available worldwide.

"Microsoft Research took the risk of funding this first stage and, once we can show success, we hope others will step up to fund development," Black says. "If we can get this oximeter out to every healthcare worker in the world, I don't think it's too much to say many hundreds of thousands of deaths could be prevented."

The flexibility and adaptability of the Microsoft software development and mobile platform technologies were critical, says Black.

Black and his colleagues are also working on other adaptations of cell phones for use in healthcare settings with limited or few resources. They are trying to design a cell phone electrocardiogram (heart monitor) that will cost less than US\$5. The Australian team is also developing software applications that use a cell phone's microprocessor to accurately estimate drug dosage schedules and fetal development in pregnant women.

A self-described activist physician, Black says he likes "building tools" aimed at improving public health for entire communities, rather than simply treating individual patients as a clinician.

"Early on, even when I was in remote clinics, I could see that things like disease surveillance and outbreak controls could be a lot easier with computers," Black says. Decades ago, he began teaching himself how to use computers and various software programs with the aim of figuring out how to make the best use of information technology to improve health in Africa.

Today, Black says, he's focused on learning more about cell phones because it's clear that the best use of information technology to improve health in the developing world will be based on mobile technology.

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