

A SMART Idea: Point-of-Care Diagnostic for Sickle Cell Disease and Malaria (Interview)

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Sickle cell disease and malaria are perhaps the biggest public health challenges in many parts of Africa. Countless organizations are tackling these two diseases, but quantifying and tracking disease burden remains tough. The team behind SMART (Sickle Cell and Malaria Accurate Remote Testing) hopes that they can help.

SMART is a point-of-care test for both sickle cell and malaria. Using a disposable cartridge and a pinprick of blood, the Gazelle portable reader can diagnose these two diseases and send patient data, test results, and GPS location to a research database or electronic medical record.

SMART is a collaboration between several organizations. **Hemex Health**, the company behind the device, licenses technology originally developed at Case Western Reserve University, while data collected will be integrated into a medical records platform developed

by eHealth Africa and University of Nebraska's International Foundation Against Infectious Disease in Nigeria (IFAIN).

We reached out to Patti White, CEO of Hemex Health, to learn more about the device, the project, and its potential impact.

Cici Zhou, *Medgadget*: *How did SMART start, and what was the inspiration?*

Patti White: My colleague and co-founder at Hemex Health, Peter Galen, and I realized that some of the most important medical tech innovations, especially those focused on underserved populations, often don't make it out of the lab setting. We wanted to use our experience in launching low-cost tech products designed for the developing world... We ultimately chose to pursue the sickle cell and malaria technologies because they solved problems impacting millions of people in developing countries and showed very promising early clinical results.



Sickle cell disease and malaria are both pervasive in Nigeria where we've focused much of our work – an estimated 150,000 babies are born annually in Nigeria with sickle cell, and 70 to 90 percent die before age 5. At the same time, Nigeria carries the highest malaria burden in Africa, with approximately 57 million cases. We're driven to make a difference in Nigeria, and we are energized by using technology to solve these global health problems.

Medgadget: *How does the technology work?*

PW: SMART is an integrated point-of care technology platform that diagnoses, tracks and monitors sickle cell disease and malaria at the point of care. The diagnostic process starts with a simple blood test from a finger prick. The sample is inserted into a cartridge that goes directly into a reader, which provides fast (one minute for malaria, eight minutes for sickle cell disease), accurate results. In the case of malaria diagnosis, magneto-optical sensors in the reader measure hemozoin levels, and in the case of sickle cell, the reader uses microchip electrophoresis to identify and quantify hemoglobin levels. The diagnosis is then displayed on the reader, and patient data, the test results, and GPS location can be stored in the reader or transmitted wirelessly to a mobile device and into an electronic medical record or database for researchers and public health officials to study.

Medgadget: *What are some key usage cases that the SMART team is looking to target?*

PW: Our goal with SMART is to offer a solution for early diagnosis of sickle cell disease and malaria in children. With early diagnosis, healthcare workers can ensure children have access to treatment and care going forward, in order to improve their quality of life and reduce the number of deaths from these diseases.

The mobile health platform, because it enables a connected point-of-care configuration, allows results to be uploaded to the cloud and integrated into a patient's medical record. This capability is especially important in Nigeria, which has had to rely on paper-based systems where transcription errors can occur, or entire files can be lost or mixed up. Having a device that can automatically upload test results can give doctors and healthcare workers a more complete record of illnesses and treatment and help them facilitate follow-up appointments and treatments.

Medgadget: *What are some of the biggest challenges facing the team?*

PW: We came across several technology and business challenges while building Gazelle... Many locations we hope will benefit from the product don't have consistent power, internet, or cell service... [and] potential end users of the solution range greatly in both skill and literacy. Given this, we had to spend time in the environment where Gazelle will be used, and we needed to conduct extensive testing and revision to create a robust, yet simple-to-use solution.

This led us to add several product features... For example, we found we needed to ensure the unit could be battery powered so that power interruptions won't affect it. And, to deal with intermittent internet or cellular coverage, we added internal storage to make the taking of diagnostic tests and transmission of results asynchronous events. Delivering SMART in an affordable manner is critical to having clinical impact. Driving the costs for the reader down and making the disposable cartridges affordable was a challenge that has been met. The cost of communication, cloud storage and management is much less expensive than current paper based methods or local compute solutions.

Medgadget: *Looking to the next 5 years, what are the biggest goals for SMART?*

PW: This year, we were very proud to have been named the first-place winner of the Vodafone Americas Foundation's Wireless Innovation Project, an annual competition that seeks to identify and fund innovations using wireless-related technology to address critical social issues around the world. Over the next three years, we are using the grant we've been awarded to further research, develop and implement SMART in communities in need.

Specifically, we will work to integrate the Hemex device (Gazelle), with its sickle cell and malaria tests and wireless capability, into the Mobile Patient Health Record System Application developed by eHealth Africa and IFAIN. We will complete the integrated mHealth platform, including EMR (Electronic Medical Records), with system validation and testing occurring at every step along the way. This pilot will be a showcase to demonstrate feasibility for other healthcare communities looking to implement similar systems.

To learn more, check out SMART on the Hemex Health website...

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