

The 10-cent tuberculosis test that's saving lives

August 28 2019, by Layne Cameron, Evangelyn Alocilja



A diagnostic tool invented by Evangelyn Alocilja, Michigan State University, detects tuberculosis in 10-20 minutes, costs 10 cents per test and is 95%-99% accurate. Credit: MSU

News of a cure for the deadliest strain of tuberculosis is making headlines around the world. However, before treatment can begin, TB must first be diagnosed.

Early detection has been a serious challenge for those suffering at various stages of this epidemic. Until now.

A colorimetric biosensing assay invented by Evangelyn Alocilja, Michigan State University professor of biosystems and agricultural engineering, detects the disease in 10-20 minutes and costs 10 cents per test. When administered by medical professionals, the results are 95 percent-99 percent accurate.

In 2016, 10.4 million people got TB and 1.7 million died—95 percent lived in low- and medium-income countries. The new biosensing assay is designed for people who need it the most, but who can afford it the least, Alocilja said.

"Implementation of this approach in [rural areas](#) of developing countries would increase case finding and notification and would reduce drug resistance," said Alocilja, who lost her aunt and uncle to TB while growing up in the Philippines. "Its use at the first point of contact would facilitate quick treatment in a single clinical visit, thus supporting the World Health Organization's global strategy to end TB by 2035."

Currently, two popularly used methods of TB detection are smear microscopy and the Xpert MTB/RIF system. Smear microscopy is inexpensive, but the sensitivity is only about 50 percent. The Xpert MTB/RIF system is sensitive, but the machine costs around \$40,000 and the cartridge costs between \$20-30 per test in TB "high burden" countries. Private testing labs charge an average of \$70 per test. It also requires electricity and refrigeration of samples—which are in short supply in developing countries.

"A few years ago, WHO's STOP TB program supplied 10 Xpert machines for the Philippines. I pointed out to one collaborator that the machines had to be stretched to cover 100 million people," Alocilja said. "In many cases, patients with TB infect five to ten people before knowing they have the disease. We simply needed a better way to save more lives."

Alocilja's patented approach uses magnetic nanoparticles and bacterial stain mixed with patients' sputum samples. The mucus discharge is mixed in a vial and exposed to a magnet. Viewing the samples through a microscope reveals either red clusters of charged nanoparticles (positive) or dispersed brown nanoparticles (negative).

For areas where there are no medical professionals nearby, Alocilja's team developed a [smartphone app](#) using an artificial intelligence algorithm that also can review the samples. Accuracy is still high (85 percent), and it serves as a great tool to extend coverage in large, remote areas.

Once TB is detected, the growing global cadre of medical professionals deploying this technology runs a DNA test, which verifies the TB strain's drug resistance.

"We are pleased with how quickly our technique can be administered," Alocilja said. "In 15 minutes, we can confirm TB, and in 45 minutes we can verify its [drug resistance](#). Being able to conduct this full assessment in an hour—and in a single visit—are critical in tackling this deadly disease."

Alocilja's team of scientists has published two papers on the efficacy of the nanoparticle-based colorimetric biosensing assay, with two papers in the works. The peer-reviewed results and the success of field studies in Nepal, India, Peru and Mexico see Alocilja traveling the world to

present to [medical professionals](#) and put her affordable sensor in the hands of those who need it most. Her next presentations will be in the Philippines as well as to 10 hospitals in Nepal on November 16-23.

Other countries that have expressed interest in Alocilja's TB invention include Columbia, Ecuador, Indonesia, Uganda, South Africa, Ghana and Poland.

More information: Cristina Gordillo-Marroquín et al. Magnetic Nanoparticle-Based Biosensing Assay Quantitatively Enhances Acid-Fast Bacilli Count in Paucibacillary Pulmonary Tuberculosis, *Biosensors* (2018). [DOI: 10.3390/bios8040128](https://doi.org/10.3390/bios8040128)

Nirajan Bhusal et al. Nanoparticle-Based Biosensing of Tuberculosis, an Affordable and Practical Alternative to Current Methods, *Biosensors* (2018). [DOI: 10.3390/bios9010001](https://doi.org/10.3390/bios9010001)

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