

Cervical cancer testing tech could replace pap smears, save lives

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Artificial intelligence monitoring for HPV (AIM-HPV) device for point-of-care HPV testing. Credit: Ismail Degani (Center for Systems Biology, Massachusetts General Hospital)

Emerging technologies can screen for cervical cancer better than Pap smears and, if widely used, could save lives both in developing nations and parts of countries, like the United States, where access to health care may be limited.

In *Biophysics Reviews*, scientists at Massachusetts General Hospital write advances in nanotechnology and computer learning are among the technologies helping develop HPV screening that take the guesswork out of the precancer tests. That could mean better screening in places that lack highly trained doctors and advanced laboratories.

Cervical [cancer](#) is the world's fourth-most common cancer, with more than 500,000 cases diagnosed every year. Almost all cases of [cervical cancer](#) are caused by HPV, or human papillomavirus. Detecting precancer changes in the body gives doctors a chance to cure what could otherwise become a deadly cancer.

Pap smears, which were introduced in the 1940s,

are subjective and not always reliable. The tests, which can detect about 80% of developing cervical cancer if given regularly, require high-quality laboratories, properly trained clinical doctors, and repeated screenings. These [test](#) conditions are not widely available in many countries or even in [low-income](#) and remote parts of wealthier nations.

"The Pap smear has done wonders in terms of reducing mortality from a cancer that is very treatable when caught early and almost invariably fatal when it is caught late," said author Cesar Castro, an oncologist at Massachusetts General Hospital and associate professor at Harvard Medical School. "And it is not even a great test. Part of its imperfection is that there is subjectivity to it. The trained eye is the limiting step in the process. The untrained eye, or relatively untrained eye, can miss cancers."

The subjectivity of the test has led to a much higher death rate from cervical cancer in lower-income countries. The authors highlight a list of existing and emerging technologies that can be used to close the testing gap in those areas. They range from existing DNA testing and other Pap smear alternatives to next-generation technologies that use recent advances in nanotechnology and [artificial intelligence](#).

One technique involves screening with tiny beads made of [biological material](#) that form a diamond shape when they contact HPV. Those shapes can be detected with powerful microscopes. When those microscopes are not available, a mobile phone app, built through machine learning, can be used to read them.

"Similar to COVID-19 testing, we have great technology in places like the United States that does not work well enough in other countries," said author Hyungsoon Im, a biomedical engineer at Massachusetts General Hospital and assistant professor at Harvard Medical School. "This is why

there is great motivation to find next-generation, affordable technology to address this problem."

More information: "Addressing cervical cancer screening disparities through advances in artificial intelligence and nanotechnologies for cellular profiling" *Biophysics Reviews*, aip.scitation.org/doi/10.1063/5.0043089

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