AI method can detect precursors to cervical cancer

17 March 2021

Johan Lundin, professorDepartment of Global Public Health, Karolinska Institutet. Credit: Ulf Sirborn

Using artificial intelligence and mobile digital microscopy, researchers hope to create screening tools that can detect precursors to cervical cancer in women in resource-limited settings. A study led by researchers at Karolinska Institutet in Sweden now shows that AI screenings of pap smears carried out with portable scanners were comparable to analyses done by pathologists. The results are published in the journal *JAMA Network Open*.

"Our method enables us to more effectively discover and treat precursors to cervical cancer, especially in low-income countries, where there is a serious lack of skilled pathologists and advanced laboratory equipment," says corresponding author Johan Lundin, professor at the Department of Global Public Health, Karolinska Institutet.

In countries with national screening programs designed to detect cell abnormalities and human papillomavirus (HPV) in cervical samples, the number of cases of cervical cancer has dropped dramatically. Despite this, the global case total is expected to increase in the coming decade, largely due to shortages of screening resources and HPV vaccines in low-income countries.

Innovative diagnostic solutions that take into account local conditions and constraints are needed if more women around the world are to be offered gynecological screening.

For this study, the researchers trained an AI system to recognize cell abnormalities in the cervix, which when detected early can be successfully treated. Smears were taken from 740 women at a rural clinic in Kenya between September 2018 and September 2019. The samples were then digitalised using a portable scanner and uploaded via mobile networks to a cloud-based deep-learning system (DLS). Just under half of the smears were used to train the program to recognize different precancerous lesions while the remainder were used to evaluate its accuracy.

The AI assessment was then compared with that made by two independent pathologists of the digital and physical samples. The study shows that the assessments were very similar. The DLS had a sensitivity of 96-100% as regards identifying patients with precancerous lesions. No patients with more serious high-grade lesions received a false-positive assessment. As regards identifying smears without lesions, the DLS made the same assessment as the pathologists in 78-85% of cases.

The researchers believe that the method can be used to exclude a majority of smears, which would free up time for local experts to examine the ones that stick out. Before this can happen, however, more research is needed on larger and more diverse patient groups, including more smears and different types of lesions as well as biopsies with confirmed precursors to cervical cancer.

"With the portable online microscope, the DLS can

act as a 'virtual assistant' when screening for cervical cancer," Lundin explains. "The AI assistant can be accessed globally 24/7 and help local experts examine many more smears. This method will make it possible for countries with limited resources to provide their population with screening services much more efficiently and at a lower cost than is currently the case."

More information: "Point-of-care digital cytology with artificial intelligence for cervical cancer screening in a resource-limited setting," Oscar Holmström, Nina Linder, Harrison Kaingu, Ngali Mbuuko, Jumaa Mbete, Felix Kinyua, Sara Törnquist, Martin Muinde, Leena Krogerus, Mikael Lundin, Vinod Diwan, Johan Lundin, *JAMA Network Open*, online March 17, 2021, DOI: 10.1001/jamanetworkopen.2021.1740

Provided by Karolinska Institutet