Computers can effectively detect diabetes-related eye problems

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People with diabetes have an increased risk of blindness, yet nearly half of the approximately 23 million Americans with diabetes do not get an annual eye exam to detect possible problems.

But it appears that cost-effective computerized systems to detect early eye problems related to diabetes can help meet the screening need, University of Iowa analysis shows.

The UI team compared the ability of two sets of computer programs to detect possible eye problems in 16,670 people with diabetes. Each of the two programs (known as EyeCheck and Challenge 2009) are based on technology developed at the UI and performed equally well, achieving the maximum accuracy theoretically expected. The study was published online April 16 by the journal *Ophthalmology*.

The systems require a trained technician to use a digital camera to take pictures of the retina, located inside the eye. The images are then transferred electronically to computers, which can automatically detect the small hemorrhages (internal bleeding) and signs of fluid that are hallmarks of diabetes damage.

"It is an important question: whether a computer can substitute for a human to detect the initial signs of diabetic eye disease," said Michael Abràmoff, M.D., Ph.D., associate professor of ophthalmology and visual sciences at the UI Roy J. and Lucille A. Carver College of Medicine and an ophthalmologist with UI Hospitals and Clinics.

"Our analysis shows that the computerized programs appear to be as accurate and thorough as a highly trained expert in determining if these initial signs of an eye problem are developing in someone with diabetes. Once the initial problems are found, an eye specialist can treat the patient," added Abràmoff, who also is an associate professor of electrical and computer engineering in the UI College of Engineering.

To explain the system's efficiency, Abràmoff said that among a group of 100 patients with diabetes, 10 people would likely have diabetes-related eye problems. An ophthalmologist (eye doctor) would have to check the eyes of all 100 patients to find out who had problems. The computer programs, when given photos of the eyes of the same 100 patients, flag on average 20 people as possibly having diabetes-related eye problems. Thus, an ophthalmologist would need to see only the 20 people prescreened by the computer program instead of the original 100.

"The computerized programs are accurate and allow ophthalmologists to spend time on patients who actually need care and provide better care to those patients. Also, through this technology, people with diabetes can have an opportunity for screening that they might not otherwise have," Abràmoff said.

Abràmoff noted the study had some limitations. For one, the images were prescreened to ensure the computers could analyze them. However, his research group has already developed the tools to automatically ensure adequate image quality before proceeding.

In addition, the number of people in the study who actually had diabetes-related eye problems was lower than what might be seen in other populations, such as people whose diabetes in not under control. Thus, Abràmoff said, it will be important to test the systems in other, larger groups. Last, the computer-based assessments were compared to assessments done by only one human reader at a time, which may not

reflect a comparison to assessments by multiple readers.

"A computer alone will never be a substitute for the care of a good doctor, but it's exciting to think that computers can be partners in finding the patients at risk of blindness who should see an ophthalmologist," said study author Vinit Mahajan, M.D., Ph.D., assistant professor of ophthalmology and visual sciences.

"In the United States alone, between 40 and 50 percent of people with diabetes are not getting the eye screening exams they need. We think these detection programs can meet this critical need very cost-effectively," Mahajan added.

Provided by University of Iowa