Results of the Retinography Study

AI-Assisted Eye Screening for Diabetes Complications

Somerset West · South Africa · June 2026

What Was This Study About?

Diabetes and your eyes

Diabetes can gradually damage the tiny blood vessels in your body — including the ones inside your eyes and kidneys, and around your nerves. The damage to the blood vessels at the back of the eye is called diabetic retinopathy, and it is one of the most common causes of vision loss in adults worldwide. The important thing is that, if caught early enough, it can be treated and vision loss can be prevented.

The traditional way to check for this condition involves a visit to an ophthalmologist (a specialist eye doctor) — which can be time-consuming, costly, and not always easy to access. Our project explored whether AI could make this screening faster, cheaper, and more widely available.

The Retinography Project

RETINOGRAPHY
RETINAL PHOTOGRAPHY

The Retinography Project (www.retinography.co.za) was launched in early 2023 by Dr Eric Falletisch's Somerset Eye practice. The idea is straightforward: a portable camera takes photographs of the back of your eye (a procedure called fundus photography, which takes only a few minutes and does not require eye drops to dilate your pupils), and an AI system (the EyeArt® screening service) then analyses the images immediately to check for signs of diabetic retinopathy.

Patients whose images show possible signs of concern are then referred to a specialist for a full examination. This creates a smarter, tiered system: the AI takes care of the first-level screening at your diabetes practice, and the ophthalmologist's time is focused on patients who really need specialist attention.

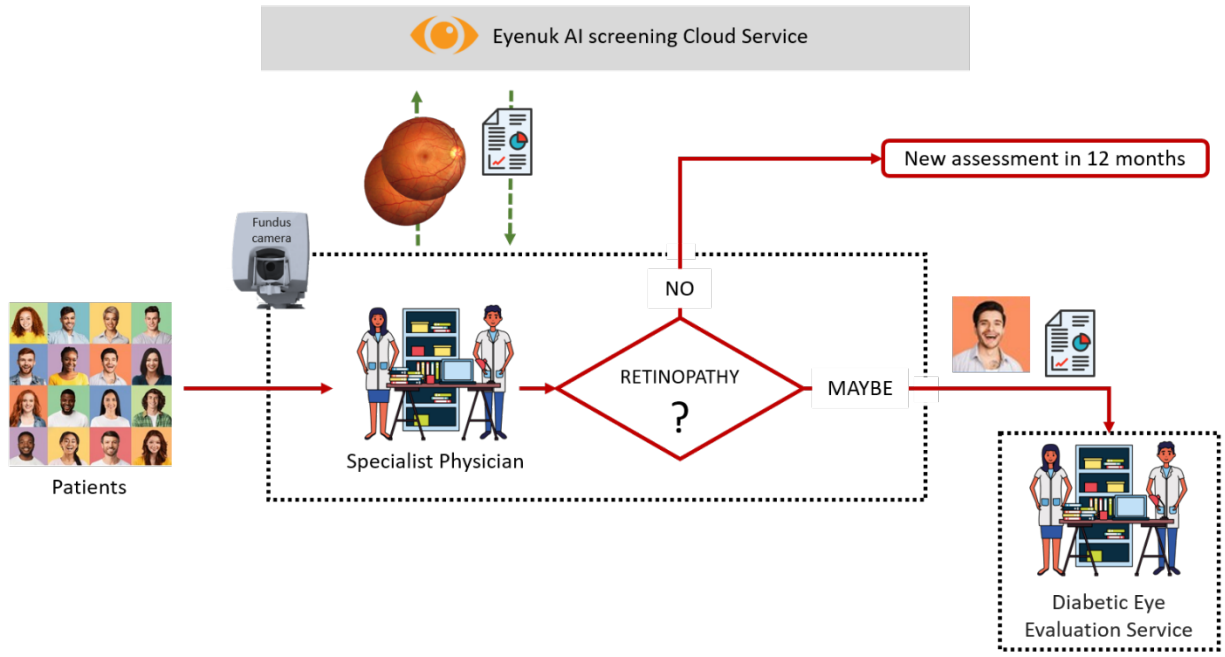

Figure 1 – How the screening process works

This study followed the first 24 months of the programme (from March 2023 to February 2025) and asked: How well does the AI actually perform? Is it as accurate as an expert? And is it more cost-effective than the traditional approach?

Who Took Part?

Out of 320 patients who were screened for diabetic retinopathy at the practice during the study period, 200 of you agreed to participate in the research study — a response rate of about 57%. Here is a brief picture of who you are as a group:

Who participated?		
Number of participants	**200**	
Gender split	**55% male, 45% female**	
Age range	**19 – 88 years**	*Average age: 55 years*
Most common diabetes type	**Type 2 (67%)**	*Type 1: 30%, LADA: 3%*
Had high blood pressure	**75%**	*Most common additional condition*
Were overweight or obese	**~80%**	*Based on BMI*
Had good sugar control (HbA1c < 7%)	**~41%**	*Slightly more common in men*

Most participants were middle-aged or older adults with long-standing diabetes and at least one other health condition. This is typical of the kinds of patients who are at greatest risk of developing complications — and exactly the group for which better screening tools are most needed.

What Did We Find? Part 1: Eye Screening with AI

How common was diabetic retinopathy in our group?

An expert ophthalmologist carefully graded each retinal photograph. Here is what was found:

- 43.6% of participants had some degree of diabetic retinopathy — though in many cases it was mild.
- 11.8% had retinopathy severe enough to need a referral to a specialist (called "referable" retinopathy).
- 8.7% had the most serious form — "vision-threatening" retinopathy — which, if untreated, can lead to significant vision loss.
- 7% had diabetic macular oedema, a condition where fluid builds up near the centre of the retina.

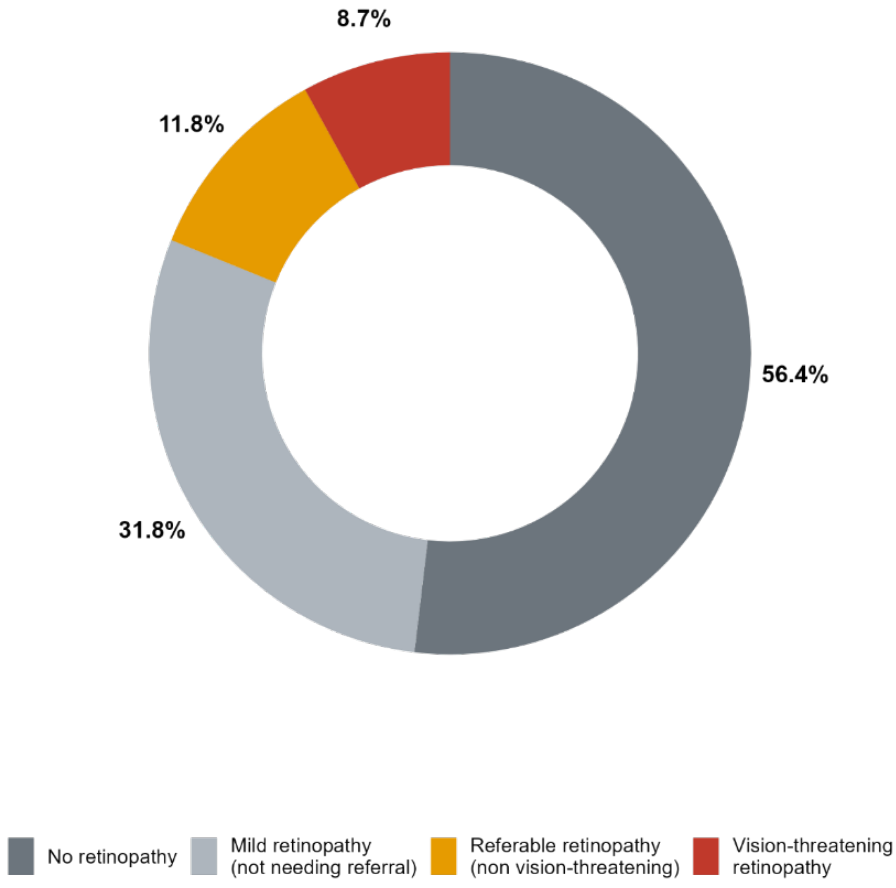

Figure 2 – Prevalence of diabetic retinopathy

These figures are similar to what is found in other populations of people living with diabetes worldwide, and they confirm how important regular eye screening is.

How well did the AI perform?

We compared the AI system's assessment (EyeArt®) with the verdict of the expert ophthalmologist. The results were very encouraging:

Key performance figures for the EyeArt® AI system:

✓ Sensitivity (ability to detect disease when present): 95.7%

- the AI correctly identified 22 out of 23 patients who needed referral.

✓ Negative predictive value: 99.3%

- if the AI said 'no concern', there was a 99.3% chance it was right.

✓ Specificity: 84.9%

- some patients without disease were flagged (false positives), but this is acceptable and expected in a screening programme.

✓ Overall accuracy (area under the ROC curve): 90%

In plain terms: the AI was very good at spotting patients who needed to see a specialist, and excellent at reassuring those who didn't. Missing a case is the biggest risk in any screening programme — and the AI only missed 1 out of 23 patients who truly needed referral. That is a very good result.

		Manual grading (gold standard)		
		Referable	**Not referable**	**Total**
EyeArt® grading	**Referable**	**22**	26	**48**
	Not referable	1	**146**	**147**
	Total	**23**	**172**	**195**

Correctly classified
False positive
False negative

Figure 3 – AI performance: a simple summary

Did patients actually attend their referral appointments?

Among those referred by the AI, 85% followed through and attended the ophthalmologist. This is a very high rate, and it tells us that when patients are informed and the referral system is well-organised, they are willing and able to engage with their eye care.

What Did We Find? Part 2: Reading Blood Vessels in the Eye

Your eye as a window to your whole body

The second part of our study asked a more ambitious question: can AI analysis of the blood vessels in your retina tell us something about the health of your heart, kidneys, and nerves — even before symptoms appear?

This idea is not as far-fetched as it sounds. The tiny blood vessels at the back of your eye are the only blood vessels in your entire body that can be directly photographed without surgery. Because these vessels share the same type of damage mechanisms as vessels elsewhere in your body, changes in their shape, width, and complexity may reflect changes happening throughout your body's vascular system. Scientists call this field oculomics — using the eye as a mirror for systemic health.

What we measured from the photographs

Using an advanced automated analysis pipeline called AutoMorph, we extracted dozens of precise measurements from each retinal photograph, including **vessel calibre** (how wide the arteries and veins are), **vessel tortuosity** (how twisted or curvy the vessels appear), **fractal dimension** and **vessel density** (measures of how complex and "branchy" the vascular network is).

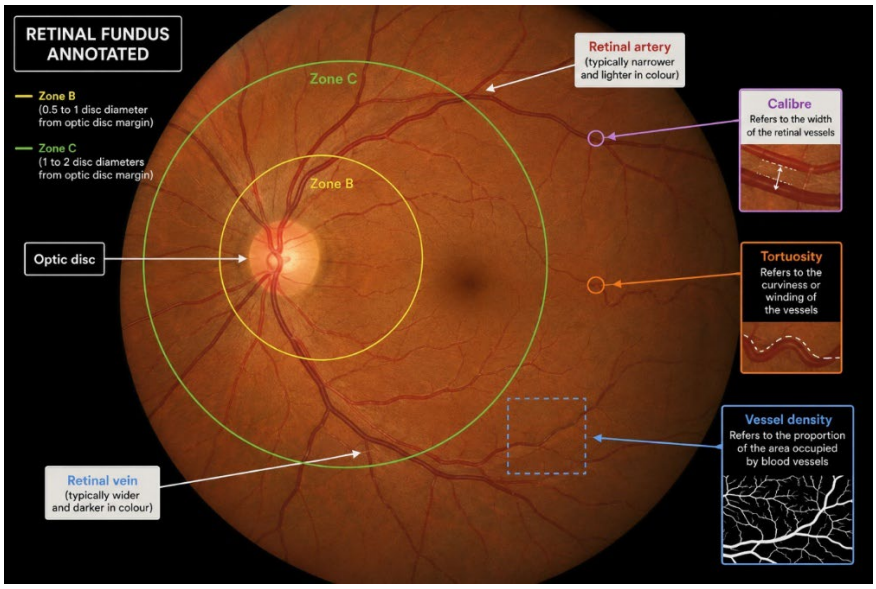

Figure 4 – What we measured in the retinal photographs

What the blood vessels told us

We then looked at whether these measurements were linked to laboratory test results and diagnosed complications. Several interesting patterns emerged:

Key findings from the blood vessel analysis:

Kidney health: Patients with poorer kidney function (lower eGFR, higher creatinine) had wider and more tortuous retinal veins — suggesting the kidneys and the retinal microvasculature are affected by the same processes.

Blood sugar control: Patients with higher HbA1c (poorer sugar control) had less complex vascular networks in their retinas — consistent with loss of small blood vessels due to chronic high glucose levels.

Cholesterol: Higher levels of LDL ('bad') cholesterol and total cholesterol were associated with more tortuous venules.

Cardiovascular complications: Certain patterns of vessel tortuosity were associated with documented heart disease and stroke.

Peripheral neuropathy: Wider retinal venules were associated with nerve damage in the legs and feet.

These are preliminary findings in a relatively small group of patients, and they should not be over-interpreted. However, they are broadly consistent with what other research teams around the world have found, and they suggest that retinal photographs could one day be used — alongside blood tests and other measurements — to give doctors a more complete picture of a patient's overall vascular health.

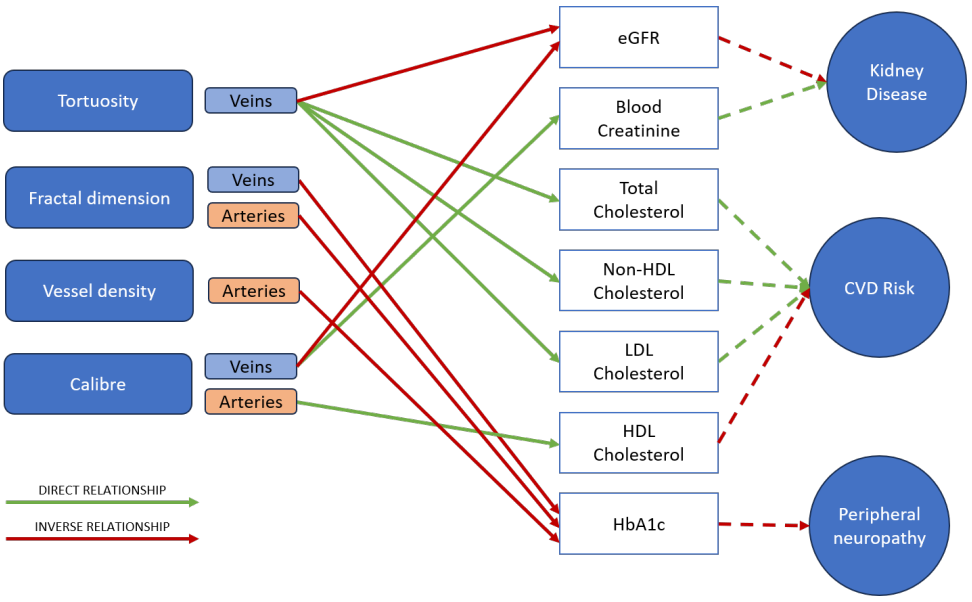

Figure 5 – How retinal vessel characteristics connect to the body

A first attempt to predict kidney disease from eye photographs

As an additional experiment, we trained an AI model to try to identify patients with early-stage chronic kidney disease directly from their retinal photographs — without any blood tests. This is a proof-of-concept: can the eye photograph alone give a signal about kidney health?

The model's performance was modest, achieving an accuracy of 73% (measured as the area under the ROC curve). This is not yet good enough to use in clinical practice, but it is a meaningful first step. The model consistently focused on the right areas of the retina — near the blood vessels — when making its predictions, which gives us some confidence that it is picking up on real biological signals rather than random noise.

Much larger studies with more patients will be needed to develop this into something clinically useful. But the fact that any signal is detectable at all is promising.

Is AI-Based Screening More Cost-Effective?

We also looked at the economics of the new screening programme compared to the traditional approach. In the traditional model, all diabetic patients are referred to an optometrist or ophthalmologist for screening — regardless of whether they actually have any retinal disease. This is expensive and creates unnecessary specialist appointments.

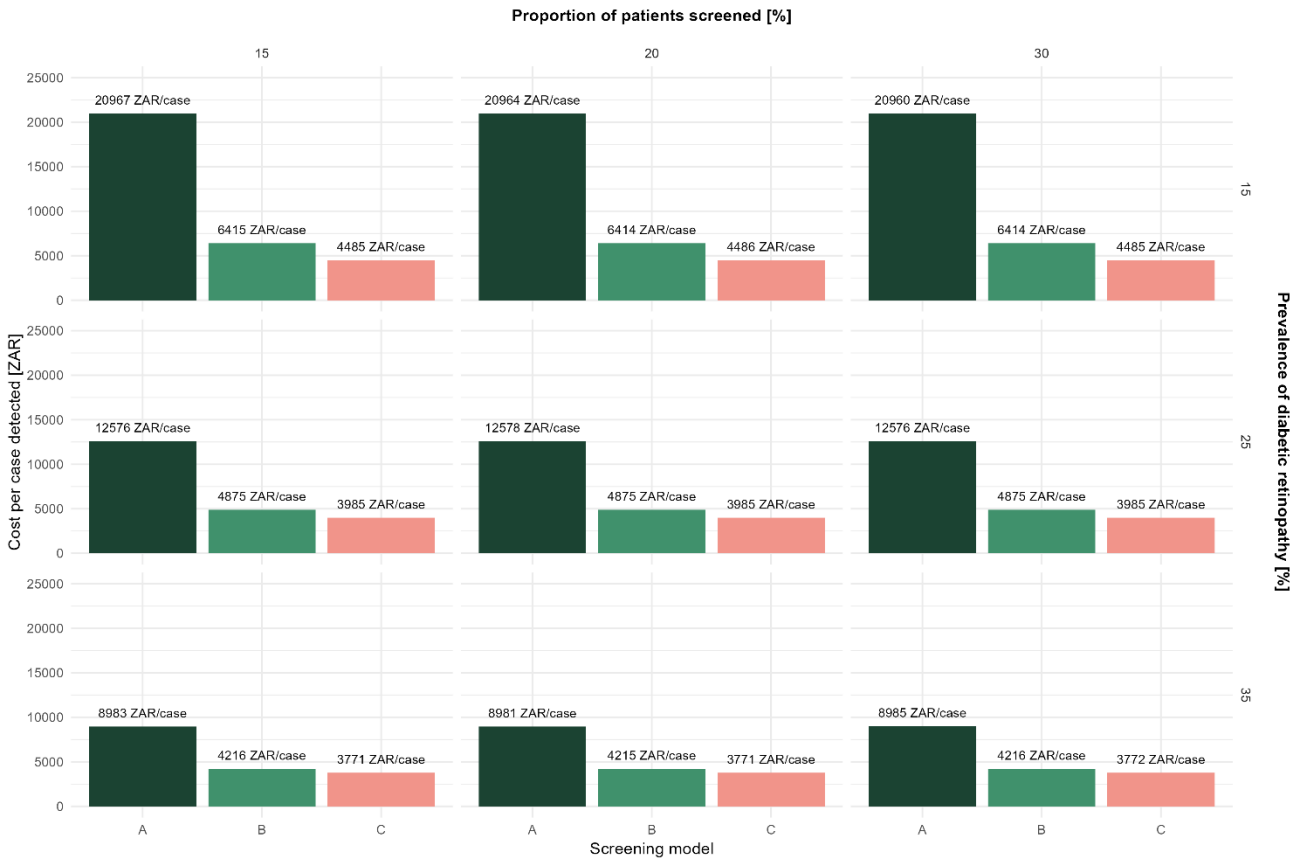

Figure 6 – Cost per case detected: AI vs traditional approaches

Figure 6 above compares the cost per case detected with three different screening approaches:

A. Refer all to ophthalmologist: the traditional approach
B. Refer to optometrist first, then ophthalmologist for those who screen positive
C. AI screening for alla patients, referral to ophthalmologist for those who screen positive.

Our analysis — using realistic assumptions about costs and referral rates — consistently showed that the AI-based approach:

- Detected more cases of diabetic retinopathy compared to traditional approaches.
- Costs significantly less per case detected — in some scenarios, the traditional referral-to-all approach costs more than 20,000 Rand per case detected, compared to far lower costs with the AI pathway.
- Is particularly cost-effective in settings where the prevalence of retinopathy is lower — precisely because it avoids sending everyone to a specialist when most patients don't need it.

These findings support the case for expanding AI-assisted retinal screening to more diabetes practices across South Africa and the wider region.

What Does This Mean for the study participants?

This study has real, practical implications for the care of people living with diabetes:

- Participants screened with the AI not founding cause for concern can be reassured: the system is very reliable at ruling out serious retinal disease.
- This type of screening can now be done conveniently at the diabetes practice, without a separate appointment at an eye clinic — making it more accessible and more likely to be done regularly.
- The information gathered in this study — including from your photographs — is contributing to a growing body of knowledge about how AI can help doctors detect complications sooner and prioritise resources more effectively.

Looking Ahead

The Retinography Project is continuing to grow. Based on what we have learned from you and your fellow participants, the next steps include:

- Expanding the network of practices using AI-assisted retinal screening, including general practitioners and optometrists, so that more patients across the region can benefit.
- Following up with participants over time to see how retinal findings relate to long-term outcomes — do those with certain vessel patterns actually go on to develop kidney disease or cardiovascular events?
- Refining the AI models for predicting systemic disease from retinal images, using larger datasets.

- Working with the public health sector to explore how AI-assisted screening could be implemented in resource-constrained settings, where access to specialists is most limited.

The results of this study will be published in scientific journals and presented at medical conferences. In all future work, participants' data will continue to be protected, anonymised, and used only for the purposes you consented to.

The Retinography Project Research Team

Dr Annibale Cois, Dr Rifqah Roomaney & Dr Eric Falletisch

An 8' videosummary of the study is available here: https://youtu.be/5ryF8YqDxAU.

For any question about the study

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