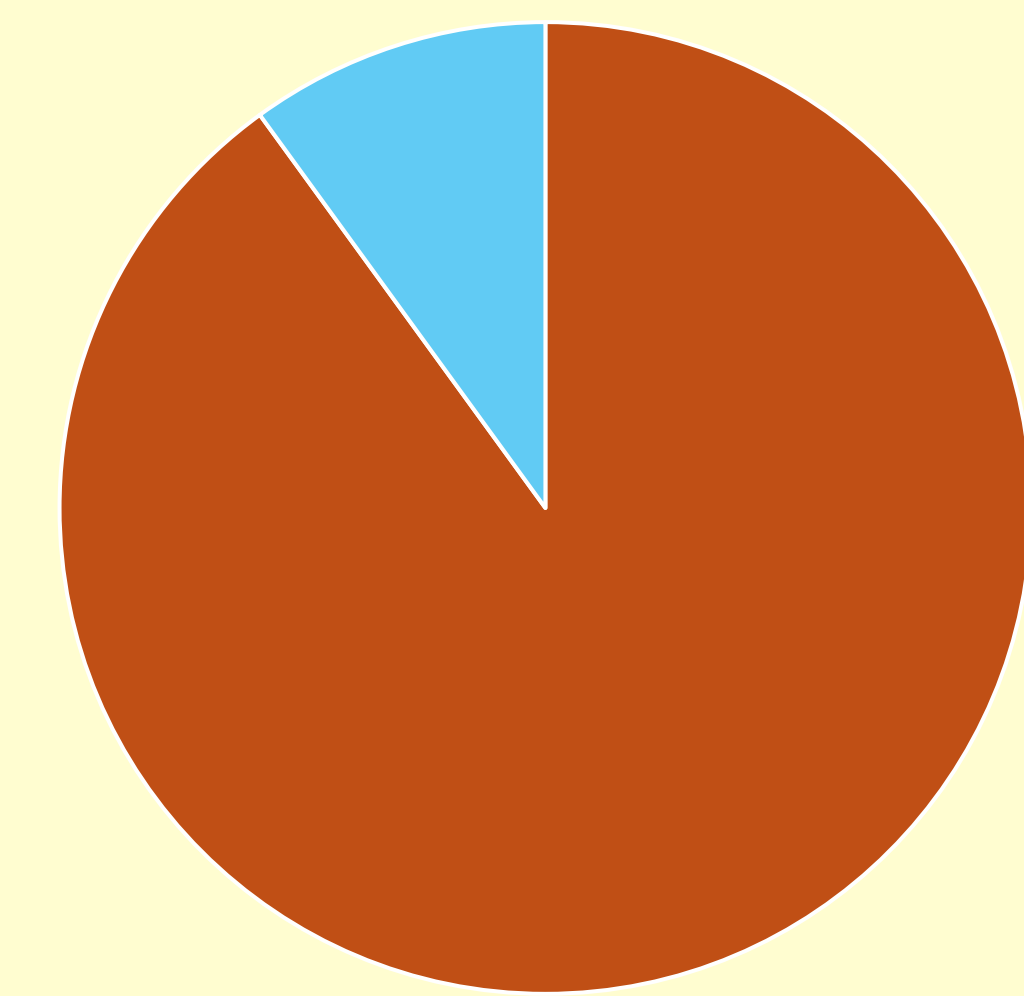


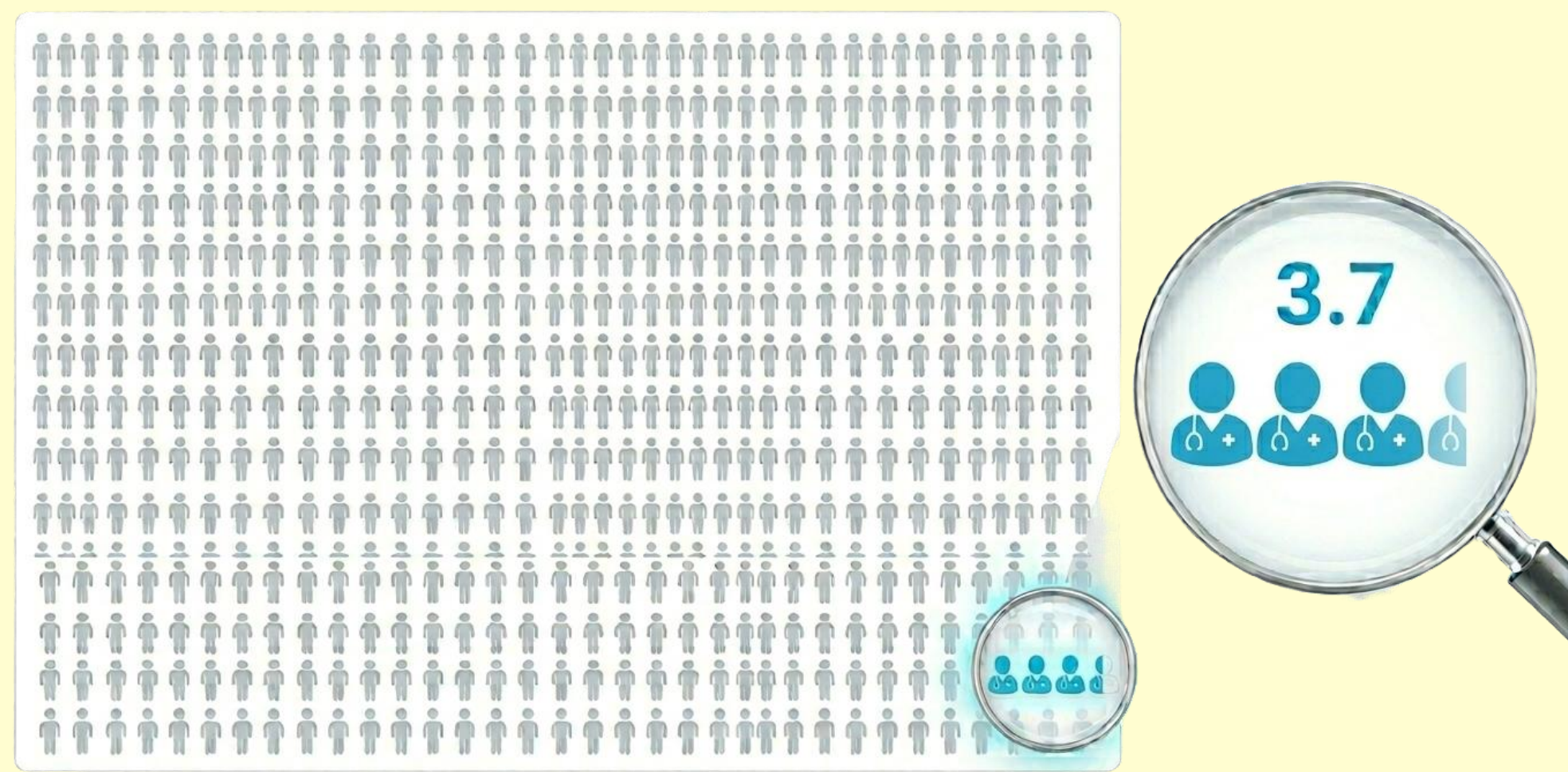
Scaling Diabetic Retinopathy Screening in Low-Resource Settings: The Role of Teleophthalmology and Artificial Intelligence

Hussien Abouzeid

-School of Medicine, St. George's University, Grenada



Low- and middle-income countries (LMICs) disproportionately bear **over 90%** of the global burden of vision loss and ocular disease.



Only 3.7 ophthalmologists per million people in low-income countries

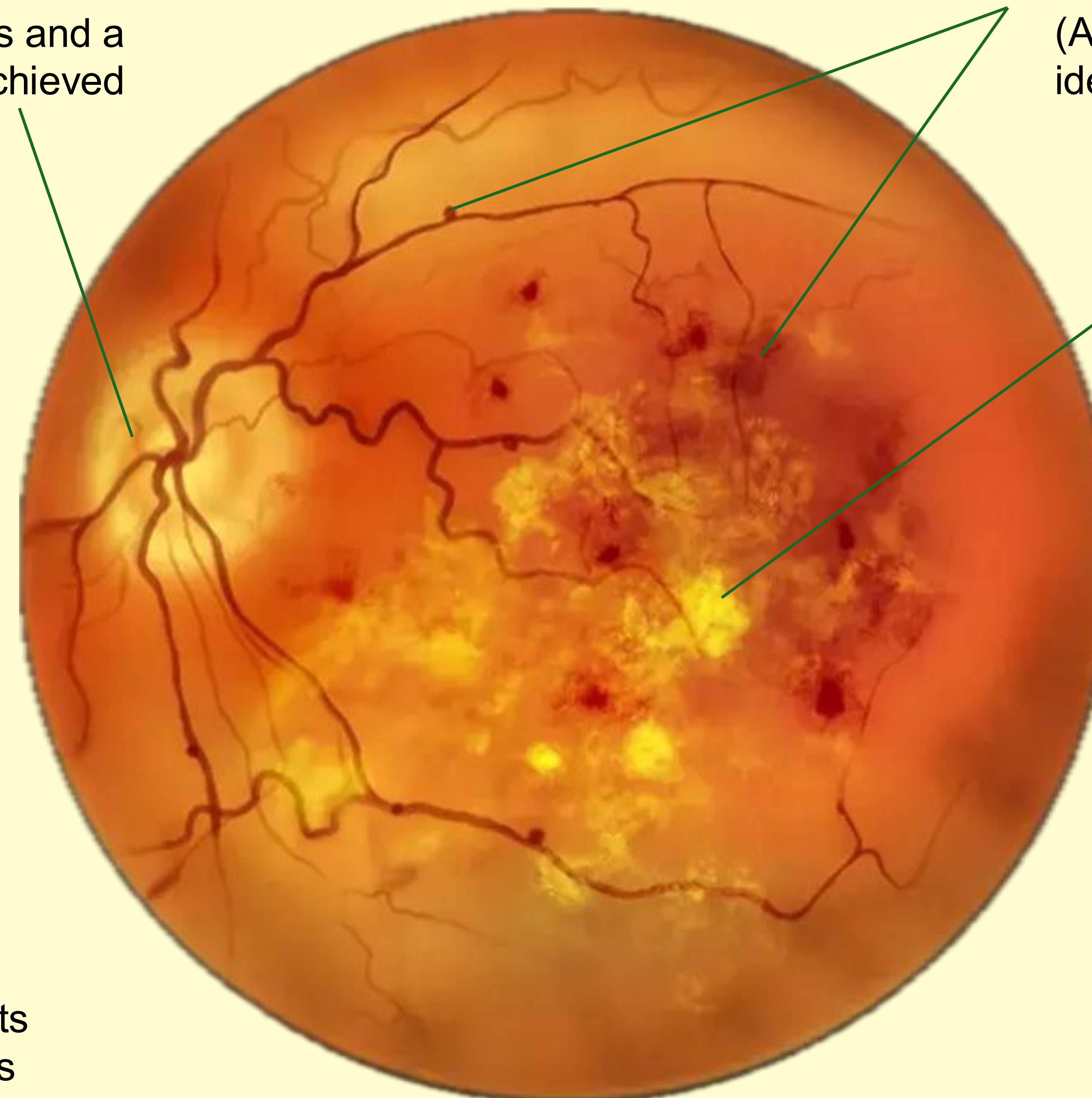


Image courtesy of VisionFirst Surgery
(<https://visionfirstsurgery.com.au/services/diabetic-retinopathy/>)

Wong et al. [1] describe a three-layer feed forward neural network that detects the microaneurysms and haemorrhages (Area under the curve: 0.97 and 0.92, respectively) and can identify the different stages of diabetic retinopathy.

Imani et al. [2] describe a Morphological Component Analysis (MCA) algorithm that screens for diabetic retinopathy by analysing exudation. 92.01% sensitivity and 95.45% specificity were achieved.

Smartphone-based ophthalmic cameras!

A handheld condensing lens paired with a smartphone camera can capture images at a relatively low cost.

Medios AI is an integrated offline system with a smartphone-based, nonmydriatic retinal camera to detect referable DR.. The sensitivity and specificity were 100% and 88.4%, respectively.



What is needed?

1. An electronic medical records registry- absent in most LMICs
2. Geographic information system mappings
3. Cooperation from local pharmacies, GPs, health workers, and diabetologists
4. Government funding- as well as NGOs, private health providers and donors
5. Quality metrics that measure the rate of referrals and treatment
6. Public awareness and incentivizing for attendance
7. Formal accreditation of graders
8. Strengthening of existing healthcare systems
9. Ethnic/ racial bias assessment

References

1. Wong LY, Acharya R, Venkatesh YV, Chee C, Min LC. Identification of different stages of diabetic retinopathy using retinal optical images. *Inf Sci* 2008;178:106-21.
2. Imani E, Pourreza HR, Banaee T. Fully automated diabetic retinopathy screening using morphological component analysis. *Comput Med Imaging Graph* 2015;43:78-88.
3. Akyol K, Şen B, Bayır Ş. Automatic detection of optic disc in retinal image by using keypoint detection, texture analysis, and visual dictionary techniques. *Comput Math Methods Med* 2016;2016:6814791.
4. Yim D, Chandra S, Sondh R, Thottarath S, Sivaprasad S. Barriers in establishing systematic diabetic retinopathy screening through telemedicine in low- and middle-income countries. *Indian J Ophthalmol*. 2021 Nov;69(11):2987-2992. doi: 10.4103/ijo.IJO_1411_21. PMID: 34708733; PMCID: PMC8725078.
5. Pasquel FJ, Hendrick AM, Ryan M, Cason E, Ali MK, Narayan KM. Cost-effectiveness of Different Diabetic Retinopathy Screening Modalities. *J Diabetes Sci Technol*. 2015 Dec 29;10(2):301-7. doi: 10.1177/1932296815624109. PMID: 26719134; PMCID: PMC4773976.
6. Natarajan S, Jain A, Krishnan R, Rogye A, Sivaprasad S. Diagnostic Accuracy of Community-Based Diabetic Retinopathy Screening With an Offline Artificial Intelligence System on a Smartphone. *JAMA Ophthalmol*. 2019 Oct 1;137(10):1182-1188. doi: 10.1001/jamaophthalmol.2019.2923. PMID: 31393538; PMCID: PMC6692680.