

# Screening for Diabetic Retinopathy in Endocrinology Clinics by Using Handheld Cameras and Applying Artificial Intelligence Algorithms

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## Abstract

According to estimations of the World Health Organization (WHO), there are almost 500M people in the world that suffer from diabetes. Projections suggest this number will surpass 700M by 2045 with global prevalence surpassing 7%. This huge population, alongside people with pre-diabetics, is prone to develop diabetic retinopathy, the leading cause of vision loss in the working age. While early screening can help prevent most cases of vision loss caused by diabetic retinopathy, the vast majority of patients are not being screened periodically as the guidelines instruct. The challenge is to find a reliable and convenient method to screen patients so that efficacy in detection of referral diabetic retinopathy is sufficient while integration with the flow of care is smooth, easy, simple, and cost-efficient. In this research, we described a screening process for more-than-mild retinopathy through the application of artificial intelligence (AI) algorithms on images obtained by a portable, handheld fundus camera.

156 patients were screened for mtmDR indication. Four images were taken per patient, two macula centered and two optic disc centered. The 624 images were taken using the Optomed Aurora fundus camera and were uploaded using Optomed Direct-Upload. Fully blinded and independently, a certified, experienced ophthalmologist (contracted by Optomed and based in Finland) reviewed each patient to determine ground truth. Indications that are different than mtmDR were also

documented by the ophthalmologist to meet exclusion criteria. Data was obtained from anonymized images uploaded to the cloud-based AEYE-DS system and analysis results from the AI algorithm were promptly returned to the users.

Of the 156 patients, a certified ophthalmologist determined 100% reached sufficient quality of images for grading, and 36 had existing retinal diseases that fall under exclusion criteria, thus, 77% of the participants met the participation criteria. Of the remaining 120 patients, the AEYE-DS system determined that 2 patients had at least one insufficient quality image. AEYE-DS provided readings for each of the 118 remaining patients (98.3% of all patients). These were statistically compared to the output of the ground truth arm. The patient ground truth was defined as the most severe diagnosis from the four patient images; the ophthalmologist diagnosed 54 patients as mtmDR+ (45% prevalence). Of the 54 patients with referable DR, 50 were diagnosed and of the 64 mtmDR- patients, 61 were correctly diagnosed by the AI. In summary, the results of the study in terms of sensitivity and specificity were 92.6% and 95.3%, respectively.

The results indicated accurate classification of diabetic patients that required referral to the ophthalmologist and those who did not. The results also demonstrated the potential of efficient screening and easy workflow integration into points of care such as endocrinology clinics.

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**Issue Section:** [Diabetes Complications and Comorbidities](#)



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