

Is Telemedicine the Future of Ophthalmology?

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Received: July 22, 2021; **Published:** August 28, 2021

The incidence and prevalence of chronic eye diseases such as glaucoma, age-related macular degeneration, diabetic retinopathy is increasing due to increased life expectancy in many parts of the world and medical advances that control the progression of the disease rather than treating and eliminating the causes. "We face enormous challenges in avoiding vision impairment as the global population grows and ages" [1]. The forecast for the year 2040 indicates that the number of patients with glaucoma will reach 111.8 million [2], with age-related macular degeneration - 288 million [3], with diabetic retinopathy - 224 million [4] respectively.

These raising numbers of persons suffered from aforementioned chronic eye diseases highlight not only medical issues, but also an economic burden, representing a medico-social challenge, to meet which it is extremely important to identify a disease as soon as possible and successfully treat it.

Which approach will be most effective?

What is the most appropriate way to provide universal comprehensive ophthalmic care with equal accessibility to all patients?

The most impactful initial approach is a screening designed to identify disease, leading to an earlier diagnosis, thus enabling earlier intervention and management in order to reduce number of patients with low vision, and specifically irreversibly blind persons. At the same time performing retinal screening examinations on all older adults is an unmet need. Millennium-minded screening will be cost-effectively based on the use of advanced digital technologies, in particular teleretinal screening systems. Starting from 1950 years promising results in image analysis was shown by machine learning based on specially designed algorithms to train machines to perform tasks [5]. However, imperfect hardware kept from performance into clinical practice to analyse medical images.

In 1956 John McCarthy for the first time uttered the term "Artificial intelligence" (AI) [6].

Initially AI was used to diagnose separately only one retinal disease: diabetic retinopathy [7-9], age-related macular degeneration [10], glaucoma [11].

Technological progress results in developing AI systems capable of simultaneously detecting multiple eye diseases [12].

Currently the ophthalmologists have the new enriched armamentarium based on cutting-edge advances in retinal imaging with automatic analysis of fundus photos and OCT scans with incorporation of telemedicine not only for remote areas, but also in COVID-19 pandemy as a hot topic, which enforces highly professionally effective time- and cost-saving care everywhere. In the proposed model the workflow and screening will be centered in the General Practitioner's office, where initially retinal and/or OCT images can be taken and sent for analysis using approved software, followed by an ophthalmologist's opinion and a personalized approach in management. Expanding access of the population to screening based on diagnostic algorithms will make it possible to detect patients with the corresponding referable disorders, which will allow ophthalmologists to treat these patients with a high success rate.

This approach will ultimately lead to earlier and better detection of attributable risk of eye diseases, which will further enable ophthalmologists to provide the best possible care for patients with chronic eye diseases.

Recently a question was raised by Korot., *et al.* [13] “Will AI replace ophthalmologists?” This should be borne in mind when weighing up the pros and cons of AI.

It’s very easy to have remarkably large data sets of quite frequent chronic eye diseases to train machines resulting in superiority of AI over human professionals in the process of detecting and grading the disease. Despite this achievement, ultimately, the evaluation of patients with the chronic eye diseases requires a multimodal approach, to allow correlation between structural and functional assessments, and undoubtedly the interaction between patient and ophthalmologist. The general consensus is that the latest has an additional therapeutic effect [14].

In summary, at present, we may consider Telemedicine and AI as some tool, which can aid in screening for common eye diseases, especially in filling the gap of inaccessibility to hard-to-reach areas, but definitive diagnosis of eye disease and it’s further management must be headed by the ophthalmologist individually in each case, and in the near future it is not feasible to replace the ophthalmologists.

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Volume 12 Issue 9 September 2021

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