

## Importance of telemedicine in diabetes care: Relationships between family physicians and ophthalmologists

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### Abstract

Diabetic retinopathy (DR) is the worldwide leading cause of legal blindness. In 2010, 1.9% of diabetes mellitus (DM) patients were legally blind and 10.2% had visual impairment. The control of DM parameters (glycemia, arterial tension and lipids) is the gold standard for preventing DR complications, although, unfortunately, DR still appeared in a 25% to 35% of patients. The stages of severe vision threatening DR, include proliferative DR (6.96%) and diabetic macular edema (6.81%). This review aims to update our knowledge on DR screening using telemedicine, the different techniques, the problems, and the inclusion of different professionals such as family physicians in care programs.

**Key words:** Diabetic retinopathy; Telemedicine; Family physicians; Clinical decisions support system; Diabetic retinopathy screening

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**Core tip:** If telemedicine is especially suited for a particular medical specialisation, that specialisation is undoubtedly ophthalmology. The enormous healthcare pressure derived from the general population's high demand for vision control and the prevalence of certain diseases which affect the eyes, such as diabetes mellitus, combined with the tremendous progress in diagnostic imaging systems in this speciality make it especially possible to send images over telemedicine networks for the diagnosis or even prevention of eye diseases, thus making the demand for the use of these types of methods extremely important.

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## INTRODUCTION

If telemedicine is especially suited for a particular medical specialization it would undoubtedly be ophthalmology. There is enormous pressure on healthcare systems by the general population's high demand for vision control and the prevalence of certain diseases which affect the eyes, such as diabetes mellitus (DM). The tremendous progress in diagnostic imaging systems make it possible to send images over telemedicine networks for the diagnosis or even prevention of eye diseases.

We should not forget that eye-care centers are often a considerable distance away from the population that require healthcare, so being able to send information over a telemedicine network is a great advantage. Good liaison among specialists, such as the ophthalmologist and the family doctor, means that it is possible to avoid patients traveling and enabling them to be diagnosed and controlled closer to home.

In spite of ophthalmology perhaps being the best example of the use of telemedicine, the reality is that its use is still far from extensive. There are many problems that ophthalmologists and other specialists who could use this communication system may face, including incompatibility among data-processing systems used by different specialists, not only among specialists and general practitioners, but even among hospital centers themselves. This is heightened by the existence of personal data-protection laws that cover the sending of images along with other personal details of patients. All this can make the regular use of telemedicine quite difficult<sup>[1]</sup>.

Even within the field of ophthalmology, not all eye diseases can benefit from the use of telemedicine, the most common being to send images of diseases that affect the retina, many of them highly prevalent.

## TELEMEDICINE IN DIABETIC RETINOPATHY

DM is recognized by the World Health Organization as an genuine pandemic<sup>[2]</sup> that affects more than 10% of the population over 14 years of age<sup>[3]</sup>, with type diabetes mellitus 2 (DM2) being the most common presentation and associated with lifestyle habits such as sedentarism or obesity. Considered a chronic disease, its morbidity is brought about by the complications it causes throughout a patient's lifetime, these being mainly derived from damage to large vessels, or macroangiopathy (complicated by cerebrovascular accidents and myocardial infarction),

or damage to small vessels, or microangiopathy, leading to nephropathy, neuropathy or retinopathy.

Eye diseases caused by microangiopathy or diabetic retinopathy (DR) are the main cause of blindness among young adults in the western world (aged between 45 and 60) and are closely related to poor metabolic control of the DM and aggravated by other comorbidities that are present in DM, such as high blood pressure, dyslipidemia or nephropathy. Early diagnosis of DR is very important because it has been shown that strict control over glycemia and high blood pressure slows the progress of the retinopathy and, if it is not present, extends the time until its appearance<sup>[4]</sup>. Screening diabetics is therefore fundamental for detecting the existence of DR as soon as possible. This should be carried out by taking retinal photographs with non-mydratic cameras, an accepted cost-effective method that makes it feasible to cover a large number of patients with DM<sup>[5,6]</sup>.

In spite of the fact that a system such as the one presented here would enable the screening of a large number of patients, with the benefit for the diabetic population this represents, the truth is that, to date, the screening of diabetic patients does not take place on a general basis and many patients with DM do not undergo regular eye examinations. So much so that in developed countries such as those in the European Union area, there are considerable deficiencies in compliance with eye examinations for diabetic patients.

With this in mind, the European "Screening for DR in Europe" group revised the 1990 St Vincent Declaration<sup>[7]</sup>. A large group of ophthalmologists and endocrinologists from 29 European countries attended a number of meetings between 2005 and 2011, which revealed a series of difficulties in applying screening recommendations. Such difficulties were identified as a paucity of information supplied to the public regarding screening visits, a shortage of teams and training programs, and insufficient collaboration among general practitioners, endocrinologists and ophthalmologists. In view of this data, it was decided to implement systematic screening programs designed to reach at least 80% of diabetics by using staff and professionals specially trained for this purpose.

When deciding to implement a system of DR screening, we need to consider what type of healthcare professional should be responsible for controlling patients with DM. In the majority of countries this is the family doctor, with control by endocrinologists being restricted to patients with very poor metabolic control of the DM.

The family doctor was, therefore, the professional who it was thought should be able to ensure collaboration with DR screening, even though there was some reticence among some sectors, especially ophthalmologists and optometrists. The insufficient number of ophthalmologists for such large populations such as diabetics, combined with different studies on the effectiveness of screening by general practitioners<sup>[8-10]</sup>, led the different working groups to decide that the family doctor needs to be involved in the DR screening programs provided they are

experts in the analysis of retinal photographs and have the support of an ophthalmologist who can supervise them, without this implying non-performance of complete eye examinations<sup>[11]</sup>. In the United Kingdom, a country where screening has been more widely developed, general practitioners are included in the programs and different professionals are involved in assessment (general practitioners or optometrists)<sup>[2,12]</sup>. Furthermore, in the authors' healthcare areas, the general practitioner plays an important role in DR screening<sup>[13,14]</sup>. It is therefore essential to impart the necessary training to these professionals so that they can detect the presence of an incipient retinopathy and establish contact with reference ophthalmologists<sup>[14,15]</sup> so that the latter can then provide the required support. If more advanced forms of retinopathy are detected, they would be able to refer the patient for treatment as quickly as possible.

Telemedicine is clearly of great use to this system of DR screening making it possible to send images and information for a correct diagnosis, and disturbing diabetic patients as little as possible.

In the authors' experience, including general practitioners and ensuring they are appropriately supervised by ophthalmologists who are experts in DR, has enabled the screening of a large number of diabetics<sup>[16,17]</sup>. Since 2007, from an estimated population of 17792 diabetics, it has been possible to screen 15396 patients (86.53%), with  $3.18 \pm 1$  visits during these 7 years. The scheme involves firstly training general practitioners, who would then be responsible for analyzing the retinal photographs of diabetics in their area. In the event of any suspicion of the presence of signs suggesting DR, the reference ophthalmologist would be consulted, and he/she then makes the final diagnosis and decides how to manage the patient. This procedure has led to the detection of an annual incidence of between 8.06% and 8.92% of patients with DR, with the incidence of patients with diabetic macular edema being between 2% and 2.8% per year. It is also important to note that between 9.2% and 10.3% of other pathologies have been detected each year, including macular degeneration associated with age, pathological myopia and the presence of pigmented lesions such as nevi. In spite of the efforts we have made in our area, only between 32.40% and 41.16% of diabetic patients undergo screening for DR every year. Part of the problem is that screening is opportunistic rather than systematic, and poor awareness among the population.

With the current world economic crisis and the explosion of the prevalence of DM we are witnessing, we should strive to ensure that screening programs are more sustainable. Measures that should be considered include: (1) Extending screening intervals for patients who do not apparently have DR and have good metabolic control (biannual is sufficient). This has been studied by some groups and proven to be feasible; (2) Developing a diagnosis aid system by implementing the design of clinical decisions support system software to enable risk

factors to be considered when scheduling successive screening tests; and (3) Automatic reading of retinal photographs. Considerable advances have been made in this field, although these systems are currently very sensitive but not specific.

## CONCLUSION

Telemedicine is a field that is extremely useful in ophthalmology and which has enormous potential, even though it is currently under-used and often limited to merely transmitting images and information about very specific pathologies such as DR or retinopathy in premature babies but has potential for many more eye diseases. Problems in data-processing systems can be solved and do not need to be an obstacle, but the lack of government regulation in many countries makes it difficult to apply in the vast majority of cases. Guidelines for government regulation are essential if communication among professionals is to increase, which can only lead to improving public health.

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