

Chapter 52

E-Health Applications in Ophthalmic Diseases: Ongoing Developments

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ABSTRACT

E-ophthalmology can be defined as the use of information and telecommunications technologies (ICT) to provide or support a group of activities related to ophthalmic care. E-ophthalmology-based models of assistance can be useful resources to compensate for the increased demand for medical care foreseeable in the near future due to aging of the population and lack of medical specialists. The authors present in detail the models proposed for three important health problems in ophthalmology as screening for diabetic retinopathy and follow-up of glaucoma and age-related macular degeneration (AMD). Furthermore, the main advantages of these models and the technologic requirements needed for their implementation are described. Finally, future trends in e-ophthalmology are also addressed.

INTRODUCTION

During the next few years, health systems in developed societies, especially in Japan and Europe, will face increased aging of the population and increased demands on health care systems. This situation, combined with decreasing numbers of health care professionals in our area, could seriously compromise the quality of current health care

(Basu, 2008). However, diagnostic and therapeutic tools in most specialties are becoming increasingly more dependent on highly sophisticated technologic advances.

Even though e-ophthalmology cannot be substituted for direct patient-doctor relations in the management and follow-up of some conditions, in many cases, it is highly reliable to put eHealth systems in place based on advanced medical devices and information and communications technology

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(ICT). Using these systems, specialists can examine results and images obtained from different diagnostic tools from a remote location. Because of these systems, less time is required, and convenient, easy access to specialty care is available to patients. The implementation of eHealth systems and the greater use of ICTs could be the most useful tools available to face the complexities of health care in the near future (Kumar, 2005).

Though some medical specialties such as radiology and cardiology have already taken advantage of these systems, other specialties could benefit. Regarding ophthalmology, the use of diagnostic images that could be converted to digital format for transmission and management makes this specialty highly indicated for the implementation of eHealth systems.

The chapter is organized as follows. First, diabetic retinopathy, chronic glaucoma and age related macular degeneration are described. Secondly, the models of e-ophthalmology proposed and the diagnostic tests currently used for the management of these conditions are explained. After that, the required technology for creating e-ophthalmology systems is addressed with an emphasis on instrumentation, the more relevant aspects of digital image, and the standards for transmission and storage using Digital Image and Communications in Medicine (DICOM). We also explain the solutions currently adopted and planned for within the complex organization of the Navarra (Spain) Health System, which provides for the health needs of over 600,000 people. Finally, future trends are explored and the conclusions from the experience of the last few years is described with an emphasis on the organizational changes that should be made within public institutions to successfully face current and future challenges, including the developments in diagnostic tools coming up from the processing of images and information that will surely benefit the health system.

CURRENT STATUS

E-ophthalmology can be defined as the use of information and communication technology to provide or support a diverse group of activities related to ophthalmic care (Kumar, 2005). E-ophthalmology can cover different areas of medical practice such as diagnosis of disease, treatment, prevention, education, and research. E-ophthalmology makes medical practice more independent of time and place, allows specialists to better organize their time, and medical services to become more accessible to patients.

The implementation of systems of e-ophthalmology requires peripheral equipment to capture, store, and transmit information and images, electronic medical records to manage the results, and protocols to organize medical attention (Tang, 2005). E-ophthalmology can be applied to screening of diabetic retinopathy, examination of the anterior segment of the eye, screening for glaucoma, consultations for poor vision, or even to provide support from a remote location during surgery. These systems can be used in real time, for example, during surgery or in a store-and-forward mode, as in the case of screening for diabetic retinopathy. The use of the system in real time is more expensive, requiring more sophisticated technology and a greater bandwidth to transmit information.

1. Diabetic Retinopathy

Diabetic retinopathy is one of the most feared complications of diabetes mellitus and an important cause of visual loss. The prevalence of diabetic retinopathy is estimated to be 3%-4% of the population (The Eye Diseases Prevalence Research Group I, 2004). For early prevention and treatment of retinal alterations, most authorities recommend annual examinations of the ocular fundus (American Diabetes Association, 2000). However, in practical terms due to the high prevalence of the disease in developed countries,

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