

Teleophthalmology's Value in Screening for Blinding Eye Diseases

INTRODUCTION

With advances in technology, medical practices are employing novel tools, such as home monitoring devices, to engage with patients on a virtual platform to provide more convenient and efficient care. Recent advancements in medical technology have allowed patients with unique medical conditions to receive care from a distance.¹

The demand for telemedicine options by patients has increased. As a result of the coronavirus disease 2019 pandemic, virtual visits increased between 257% and 700%.² During the pandemic, patients were able to connect with their healthcare providers remotely, reducing the risk of viral exposure. Virtual visits were especially valuable to individuals with chronic medical conditions who require continuous care but were also at a higher risk of severe acute respiratory syndrome coronavirus 2 infectivity.³ These instances demonstrate the willingness and capability of both patients and medical practices to utilize telemedicine.

Ophthalmology practices, in particular, had a need to employ telemedicine options including virtual check-ins and telehealth visits to communicate with patients. On March 18, 2020, the American Academy of Ophthalmology highly recommended that ophthalmologists only provide care in urgent cases to minimize the risk of contracting coronavirus disease 2019 pandemic. Eye specialists are particularly at risk as a result of the proximity involved during an eye examination and the risk of transmission through fomites and microfomites.^{4,5}

Despite the pandemic, it is evident that telemedicine will continue to play a major role in ophthalmology. The following commentary discusses some of the technology available, the benefits for both patients and ophthalmologists as well as risks and limitations associated with teleophthalmology.

TECHNOLOGY-BASED EYE CARE SERVICES CURRENTLY BEING USED

Although the coronavirus disease 2019 pandemic has brought more attention to telemedicine, telemedicine in ophthalmology has been used years before the pandemic to diagnose and monitor conditions such as glaucoma, diabetic retinopathy, and age-related macular degeneration. A traditional face-to-face visit for diagnostic purposes involves pattern recognition and multiple imaging modalities. Instead, these can be collected in patients' homes and sent to physicians for interpretation.

This method of "store and forward" telemedicine is used most commonly in Diabetic Teleretinal Imaging which aims to reduce

blindness from diabetic retinopathy.⁶ Diabetic retinopathy is a condition which is often asymptomatic in its initial stages and can lead to vitreous hemorrhages and retinal detachment if uncontrolled.⁷ The current method for screening involves a primary care physician's referral to ophthalmologists. With this method, it is estimated that only half of individuals at risk undergo the recommended screening due to various factors such as cost, transportation, or lack of local ophthalmologists.⁸ However, teleretinal imaging proves beneficial when compared to a physical screening examination as an initial teleophthalmology examination allows the consultant to plan for testing and treatment during a patient's first in-person visit enhancing and expediting care options. Similarly, patients' progress can be followed without any need for further travel and hence can lower barriers to screening for individuals who live in rural areas.⁶

Age-related macular degeneration is another condition which can be diagnosed and monitored using telemedicine. Age-related macular degeneration is a condition in which the macula, the central part of the retina, leading to vision loss.⁹ Although telemedicine does not provide an alternative option for the treatment of age-related macular degeneration, it does allow for diagnosis and monitoring of the condition.² A study tested if home monitoring, using the ForeseeHome device (Notal Vision, Incorporated, Manassas, Virginia), resulted in earlier detection of age-related macular degeneration with choroidal neovascularization, which consists of abnormal vessels within or under the retina.¹⁰ This visual field monitoring device was based on testing hyperacuity by presenting artificially distorted images of various magnitudes. The patients using these devices can detect the more significant distortions allowing for the creation of a quantified visual field map for each eye, longitudinal changes, and deviation from the general population. Researchers found that choroidal neovascularization was detected earlier in high-risk patients who were using the home monitoring device and concluded that home monitoring would be beneficial in both the screening and monitoring of age-related macular degeneration.¹⁰ As age-related macular degeneration requires recurrent ophthalmic care and primarily affects an elderly population, home monitoring, and teleophthalmology provide an alternative way of evaluating patients without exposing this high-risk population to severe acute respiratory syndrome coronavirus 2.

Similarly, glaucoma detection has benefited from Technology-Based Eye Care Services methods, an initiative present throughout the Veterans Affairs Healthcare System. Glaucoma is a group of diseases which can cause irreversible damage to the optic nerve if not detected and prevented and is usually associated with high intraocular pressures.¹¹ A study testing the accuracy of Technology-Based Eye Care Services compared to face-to-face diagnostic methods collected data using a variety of tools to collect crucial data points: autorefractometry (ARK-1S,

Marco, United States of America), intraocular pressure (iCare tonometer; Raleigh, North Carolina), corneal pachymeter (Accutome Pachpen; Malvern, PA), and anterior chamber depth (Finhoff transilluminator; Welch Allyn, Skaneateles Falls, New York). Patient data were collected along with their chief complaint, ocular, medical, and family histories and sent to eye care clinicians to be reviewed. The results of this study indicated that the Technology-Based Eye Care Services protocol was substantially consistent with the face-to-face examination.⁶

Teleophthalmology has also been beneficial in the sphere of pediatrics, specifically in diagnosing strabismus and retinopathy of prematurity. For strabismus, clinicians were able to use images from a low-cost camera to create a treatment plan and even obtain surgical consent. For retinopathy of prematurity, Stanford University's Network for Diagnosis of Retinopathy of Prematurity program provides evidence of a successful screening program with a sensitivity rate close to 100% over a 6-year retrospective analysis.¹²

Technology-Based Eye Care Services offers an alternative method to the screening and monitoring for all four of these serious eye conditions and proves beneficial both during and beyond the pandemic.

INCREASING PATIENT-PHYSICIAN ENGAGEMENT THROUGH TELEMEDICINE

As the importance of teleophthalmology grows, it is worthy to note the impact of telemedicine on the patient-physician relationship. Compared to a traditional clinic visit, telemedicine sets a technological barrier making it difficult to maintain all aspects of an in-person visit. As a result of the coronavirus disease 2019 pandemic, the requirement that physicians and patients must have an established relationship has now been waived by the Centers for Medicare and Medicaid Services.³ However, this poses a challenge in achieving the trust that patients feel when visiting their regular ophthalmologist. Overall, telemedicine visits tend to be more physician-centered, focused solely on verbal communication, and are more repetitive as patients often require clarification of the virtual conversation.¹³

Despite these drawbacks, teleophthalmology is a vital tool and there are ways to improve the patient-physician relationship. It is best if care providers develop skills such as rapport building and performing "facilitated" physical exams over a virtual platform.¹⁴ If possible, the first patient visit should be held in-person, to first establish a relationship. Future visits can then be transferred to telemedicine to avoid unnecessary hospital visits, long wait time, and delays in relaying test results.¹⁵ Introducing patients to an online platform can increase their willingness to engage with their physician more frequently over a telemedicine platform.¹⁶ It is important to have clear verbal, written, and visual instructions available for patients before performing a telehealth visit to ensure both patient and physician satisfaction with the process.

In assessing patient satisfaction with telemedicine platforms, the measures of virtual waiting rooms, privacy and security, and easy scheduling are important.¹⁷ Improving these components of telemedicine through minimizing wait times, maximizing security, and optimizing scheduling have the potential to increase patient engagement as well. In addition, providing cultural sensitivity training could increase patient satisfaction and communication between patients and their providers.¹⁸

When teleophthalmology services were provided, patients reported an 88% satisfaction level due to convenience and visualization of their retina.¹⁹ Furthermore, allowing patients to interact with images of their own eyes and actively annotating those images during appointments could also increase patient engagement during teleophthalmology appointments. Similarly, patients who routinely set up virtual teleophthalmology appointments reported higher awareness of their own health conditions even when they had never had an in-person appointment.²⁰

In the current pandemic state with mandatory masking and social distancing policies, there has been a negative impact on speech quality and understanding. It is very difficult to convey body language, facial expressions, and visual cues while wearing masks. However, this barrier can be reduced through telemedicine visits as neither party is wearing a facial obstruction.²¹ These results indicate the potential that teleophthalmology has toward improving patients' health outcomes and satisfaction when engaging with them virtually.

LIMITATIONS OF TELEOPHTHALMOLOGY

While the emergence of telemedicine has proven useful in the ability to meet the ever-increasing demand of patient care, there are undoubted pitfalls to the use of telemedicine. Despite their value, virtual visit reimbursement is not clearly defined for some services, and providers and patients both are dependent on access to technology and the technological knowledge necessary to engage in virtual care.¹²

Of equal importance, is the lack of access to the technology required for telehealth services, this may include internet services, computers, or smart devices. Furthermore, telehealth requires a level of technological competence, by both provider and patient, to successfully complete telehealth visits. Limited knowledge of telehealth software or concerns regarding the security of personal health information, specifically cyberattacks, are impediments to offering telehealth.¹² A 2015 study investigated the adoption of telemedicine services for addiction treatment and found the costs associated with implementation, lack of reimbursement for telemedicine services, confidentiality regulations, and providers' unfamiliarity with technology were major barriers.²²

In conclusion, despite identified obstacles, teleophthalmology serves as a valuable and ever-expanding tool in providing access to ophthalmic care. The convenience, efficiency, and improved access to ophthalmologic care lead to a higher

level of patient satisfaction. By removing some of the current barriers to routine eye care, such as the geographical distance and limited availability to see an ophthalmologist, overall patient outcomes, including vision loss and blindness, should improve.

Treatment and/or screening of some of the most prevalent ophthalmic pathologies including glaucoma, diabetic retinopathy, and age-related macular degeneration is possible through teleophthalmology. Medical devices and Technology-Based Eye Care Services provide ophthalmologists access to comprehensive clinical patient data that may be used to guide treatment plans.

Similarly, the spread of teleophthalmology programs will promote access to retinal screening or eye tests with the appropriate frequency which in turn will allow patients to actively take part in monitoring their own health. This increased engagement often results in improved patient compliance, leading to better outcomes.²³ From taking a patient's history and gathering clinical data, to communicating an effective assessment and treatment plan, teleophthalmology often possesses the capacity to provide sufficient information to guide clinical decision-making from a distance.

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