

Telemedicine and Remote Imaging for Diabetic Retinopathy Evaluation: An Update

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Recent estimates have revealed that 4.2 million people, or 28.5% of individuals with diabetes older than 40 years old, have diabetic retinopathy, and 655,000 (4.4%) of these individuals have advanced retinal disease that could lead to vision loss.¹

It is well known that early detection of DR is crucial to preventing blindness. Medical and surgical therapies have dramatically reduced the disease's progression, and timely intervention can reduce the risk of severe vision loss by more than 90%.² While annual retinal evaluations are recommended by the American Academy of Ophthalmology, the National Committee for Quality Assurance, the National Eye Institute, the Centers for Disease Control and Prevention, and the World Health Organization, overall retinal evaluation rates for DR remain less than 50% in the United States.³

Barriers to improved DR surveillance include socioeconomic factors, geographic challenges, and lack of patient and physician awareness regarding the importance of annual retinal examinations, as well as cultural barriers among minorities.^{4,5} As the prevalence of diabetes is projected to increase from 25 million to 125 million Americans by 2050,⁶ the number of patients with diabetes requiring annual retinal evaluations will far exceed the capacity of ophthalmologists. Therefore, a new paradigm for the care of these patients is needed.

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ENTER TELEMEDICINE

Telemedicine is an emerging adjunct means of providing health care. It is one strategy for improving DR evaluation rates through retinal imaging with remote expert interpretation. While many patients with diabetes will not see an ophthalmologist regularly, they will see their primary care physician, on average, three to four times annually.

Therefore, introducing telemedicine technology at the point of care of the PCP could substantially reduce the above barriers and improve rates of early detection of DR. Internationally, the United Kingdom has implemented the best example of a widespread successful DR telemedicine program, which ensures that nearly 80% of all patients with diabetes nationally are assessed for diabetic eye disease.⁷

In the United States, the largest DR telemedicine program is in the Veterans Health Administration, which has successfully performed more than one million imaging sessions on veterans with diabetes over the past five years.⁸

CHAPEL HILL'S TELEMEDICINE PROGRAM

Locally, we have demonstrated the success of a telemedicine network for DR evaluation at the University of North Carolina at Chapel Hill.⁹ Over the past four years, we have collaborated with three primary care clinics with a diverse patient and payer mix in the family medicine, general internal medicine, and endocrinology departments.

The nuts and bolts of the program were as follows: patients with diabetes who had not received a retinal evaluation in the previous 12 months were identified. During their regular primary care visit, patients were imaged with a nonmydriatic camera.

The images were securely sent over a HIPAA-compliant, Web-based network¹⁰ to a retina specialist (SG), who

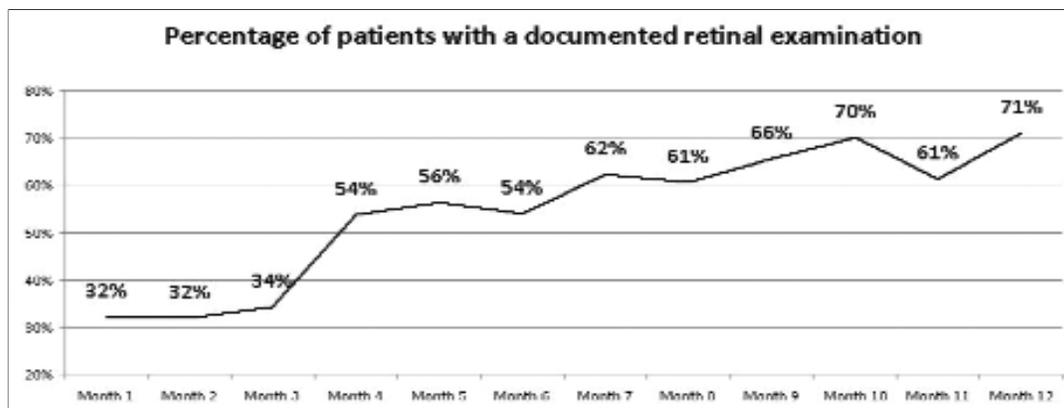


Figure 1. Percentage of patients with a documented retinal examination for DR over a 12-month period at the UNC-Chapel Hill Family Medicine Department after the implementation of a DR telemedicine network.

remotely classified the retinal images according to the severity of retinopathy. A report detailing the findings and referral recommendations was transmitted to the originating PCP within 48 hours and was incorporated into the patient's electronic medical record.

Based on the degree of DR, the patients were either scheduled for repeat follow-up retinal imaging in the primary care clinic in one year (no DR or mild to moderate DR with no macular edema), or they were referred to an ophthalmologist for further management (any ungradable image, findings suggestive of macular edema, severe non-proliferative DR, or any proliferative DR).

In one year, a total of 1,002 diabetic patients in the Department of Family Medicine were evaluated for DR, resulting in an increase in DR evaluation rates from 32% before implementation of the telemedicine network to 71% (Figure 1). In the other departments, in which the rates of screening were already more than 70%, efficiency and patient satisfaction improved.

In addition to numerous other successful local telemedicine DR assessment programs, there are several large-scale validated programs in the United States that have each already successfully imaged more than 150,000 patients for DR evaluation, including the Joslin Vision Network and EyeTel Imaging, Inc.^{11,12}

BARRIERS TO SUCCESS

With such success internationally, nationally, and locally, why has telemedicine not achieved more widespread implementation in the United States? Difficulty establishing a sustainable business model due to equipment costs and an unclear reimbursement system, as well as lack of acceptance of telemedicine by the ophthalmologic community, are some of the factors associated with underutilization of telemedicine as a DR assessment strategy.

Issues of Infrastructure

The infrastructure required for a telemedicine retinal imaging program is one of the major barriers to large-scale deployment of such a system in the primary care environment. Most individual primary care practices have relatively small populations of patients with diabetes, and the cost of a retinal camera is often difficult to justify given the number of patients requiring imaging.

Commercially available fundus cameras, mydriatic or nonmydriatic, average more than \$20,000 in cost. Placing a camera in numerous practices thus becomes a prohibitive expense.

Additionally, there are multiple other components of a telemedicine DR assessment program, which incur costs including training and continuing education of personnel, ongoing quality assurance measures, reading centers with supporting software, and information technology specialists to establish communication between imaging sites and reading centers.

While research and development of retinal imaging devices is currently very active, a truly low-cost fundus camera (less than \$1,000) is not currently available.

Reimbursement Barriers

In addition to the costs of implementing a remote DR assessment program, the current uncertain reimbursement structure in the United States further challenges the establishment of a financially viable business model.

Outside of single-payer models, such as the Veterans Health Administration, DR telemedicine programs depend on coverage for the service and appropriate reimbursement to remain financially sustainable.

Traditionally, the Current Procedural Terminology (CPT) code used to bill for retinal telemedicine services has been 92250 (fundus photography with interpretation

and report). The reimbursement for this service was often split into the technical component, which the PCP's office received for its work in acquiring the images, and the professional component, which the reading center or specialist interpreting the images received.

Some telemedicine programs still use the fundus photography code (92250), in particular through agreements with commercial insurance carriers. However, in 2011, two new CPT codes, sponsored by the AAO, were introduced specifically for remote retinal imaging.

- 92227: Remote imaging for detection of retinal disease (eg, retinopathy in a patient with diabetes) with analysis and reporting under physician supervision, unilateral or bilateral.
- 92228: Remote imaging for monitoring and management of active retinal disease (eg, diabetic retinopathy) with physician review, interpretation, and reporting, unilateral or bilateral.

These new codes create distinct reimbursement issues. CPT code 92227 implies that nonphysician readers under physician supervision read the images; therefore, it has a very low reimbursement rate. For most telemedicine DR programs, the reimbursement level of code 92227 does not cover the incurred costs.

In contrast, CPT code 92228 applies to images read by a physician and has a more reasonable reimbursement rate. However, it is only appropriate for cases with "active disease," ie, only if DR is present.

In the published literature, most DR screening programs average 60% to 70% of all patients imaged, who have no appreciable DR. This means that code 92228 cannot be used to bill for the majority of patients remotely imaged in a typical DR assessment program.

These two new codes do not adequately describe the imaging services being provided by most telemedicine DR assessment programs, and their clinical utility is still evolving. Clearly, widespread coverage of DR assessment services, with remote retinal imaging and an appropriate reimbursement structure, is needed for telemedicine programs to remain financially tenable.

No Loss of Referrals

A common misconception among ophthalmologists is that the use of telemedicine services will result in decreased referrals of patients with diabetes for eye evaluations. However, the goal of telemedicine DR programs is to capture noncompliant patients with diabetes who have not had an eye evaluation in the past year and are not likely to do so in the near future.

Patients who are imaged remotely and have appreciable DR are referred to an ophthalmologist, which ultimately results in increased referrals, particularly for patients potentially requiring treatment. With the current paradigm, we are

failing to evaluate up to half of U.S. patients with diabetes.

While remote retinal imaging does not replace a comprehensive eye examination, telemedicine has the potential to reach a greater percentage of the population at risk for vision-threatening retinal disease than is currently being captured by conventional means.

Ultimately, telemedicine is expected to result in more referrals to ophthalmologists, certainly for those patients that need more subspecialty retinal care.

CONCLUSION

If the aforementioned barriers can be overcome, telemedicine for DR evaluation has the potential to decrease the risk of vision loss from DR. It establishes a logical partnership between primary care physicians and retina specialists by facilitating the identification of patients who are at high risk of vision loss from diabetes and who may not seek the recommended annual evaluation by an ophthalmologist.

In time, barriers such as retinal camera cost and sub-optimal reimbursement will hopefully be resolved. Telemedicine assessment for DR represents a potential paradigm shift in the management of the retinal complications of diabetes and could make a major public health contribution by ultimately reducing barriers to care and preventing vision-threatening DR. RP

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