Teleretinal Screening for Diabetic Retinopathy: A Novel Approach to Reduce Screening Burden on the Healthcare Systems within Central Texas

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BACKGROUND AND RATIONALE
The prevalence of diabetes in the United States is expected to increase from 27.8 million in 2007 to 60.7 million in 2030, a sharp increase from 12.9% to 22.7% of the general population.1 Diabetic retinopathy is the leading cause of blindness among Americans aged 20 to 74 years and is estimated to affect over a quarter of patients with diabetes.2 In the state of Texas, the total prevalence of diabetes was 2,132,645 people in 2013, or about 10.9%. In Travis County specifically, the prevalence of diabetes was 69,862 people in 2013, or about 9.3% of the population.3

According to guidelines set forth by the American Medical Association, when a patient is diagnosed with Type 1 diabetes they should have annual screenings for diabetic retinopathy beginning 5 years after the onset of their disease. If the patient is diagnosed with Type 2 diabetes, they should schedule an examination immediately after the time of diagnosis, with yearly follow-up examinations.4

It is well understood that time-sensitive treatment of diabetic retinopathy is both clinically beneficial and cost effective5 and early detection is key to improved outcomes. A recent study examining the follow-through rate of diabetic patients who were screened and referred to a specialist showed that only 30% of the referred patients are actually seen by an eye care specialist trained in diabetic eye disease.2

Our healthcare system faces many issues that contribute to this shortcoming. These may include lack of access to care, a fragmented health care delivery system, a shortage of healthcare providers, or outdated technological infrastructure.

Historically, at Austin Retina Associates (ARA), a retina-only ophthalmology practice located in Central Texas, under the traditional referral process, we estimate that only about 25% of patients referred from the Community Care Collaborative clinics for diabetic examinations actually present for their initial screening appointments. Even with aggressive appointment reminders by phone call from the staff at ARA to these patients, those numbers only improved to about 40-50%.

Teleretinal screening is a well-established method to effectively screen patients with diabetic retinopathy.1 Screening for diabetic retinopathy begins at the point of care from a primary physician’s office where a patients’ retinas are photographed with a digital fundus camera and the images are uploaded to a cloud-based platform. There,
the images are accessed by a remote reading center and evaluated for pathology. If pathology is detected, an appropriate referral to a retina specialist depending on degree of retinopathy is made. If no pathology is detected, the patient is scheduled for a repeat teleretinal screening in 1 year.

Austin Regional Clinic (ARC) is a large, private medical practice with locations throughout central Texas offering primary care as well as several specialty services. Close to 99% of patients seen at ARC have either government (Medicare/Medicaid or private, commercial health insurance. In Central Texas, patients who are uninsured, underinsured or have incomes below the poverty line may be eligible to receive healthcare through Central Health, a safety net organization that serves this population with funding from charity and municipal, state and federal subsidies.

Because each of the primary care offices of both health systems are located within 5 miles of an eye doctors, there is no “geographical” barrier to seeing an ophthalmologist for routine diabetic screening. Nevertheless, screening rates remain low.

Teleretinal screening may reduce the burden of the screening process on the patient, the referring primary care practice as well as the ophthalmologist and ultimately improve screening rates. Our study evaluates the effect of teleretinal screening programs in the central Texas population over both commercially insured and under/uninsured safety net populations.

PURPOSE
To retrospectively analyze the impact of a novel, teleretinal screening protocol for diabetic retinopathy and a streamlined referral process for diabetic patients within the ARC and Central Health network over a 12-month period and six month period, respectively.

Specifically, to report on the prevalence of diabetic retinopathy including severity of disease as well as other ocular pathology seen in diabetic patients in Travis County and surrounding counties.

To report on the capture rate of patients detected with diabetic retinopathy. The capture rate is defined as the percentage of patients with detected retinopathy via teleretinal screening who schedule and attend an appointment with a retina specialist.

To analyze differences in diabetic retinopathy rates across each of the primary care locations throughout central Texas.

PROCEDURES
Pertinent health information from Intelligent Retinal Imaging System (IRIS) telemedicine screening database in ARC and Central Health clinics will be compiled and analyzed. This will include identifying patient demographic information, rates of diabetic retinopathy, rates of follow up and need for treatment.

The initial screening takes place at the initial point of care within the primary care provider’s office using a non-mydriatic (undilated) fundus camera. There are six ARC primary care clinics and two Central Health clinics with cameras. The image is then uploaded to IRIS’s cloud based platform where they can be remotely accessed and graded by retinal physicians at Austin Retina Associates.

After the images are graded and reported back to the primary physician’s office, if there is pathology necessitating further evaluation by a retina specialist, the patient is contacted for an appointment by a referral coordinator from Austin Retina Associates.

Data from IRIS will include evidence of diabetic retinopathy (DR) and Diabetic Macular Edema (DME), as well as level of DR and DME. Whether or not the image could be graded will also be recorded.

If no diabetic retinopathy or other ocular pathology is detected, the patient is advised to return for a scan in 12 months. For mild diabetic retinopathy (DR) or diabetic macular edema (DME), an appointment within six months is advised. Moderate DR or DME prompts a visit within one month. If the patient has severe DR or DME or proliferative DR, they are scheduled an appointment within 2 weeks. Other pathologies, which may be noted, have specific recommended follow up times.

Period prevalence of diabetic retinopathy and diabetic macular edema were calculated for each of the locations. Statistical analyses were completed comparing these rates across each of the locations for both diabetic retinopathy and diabetic macular edema.

Patient capture rate (the percentage of patients requiring further examination by a retina specialist who actually came in for an appointment) was also calculated.

A geographical map detailing the distribution of diabetic retinopathy will be created.

KEY FINDINGS AND CONTRIBUTIONS

For the Central Health patients, 1830 patients were screened over a six month period from April 2015 to October 2015. Severity of DR and presence of DME in both
clinics is shown in Figure 1. Overall period prevalence of DR was 26.6% (486/1830). Prevalence of DR was significantly higher in the south location at 28.9% as compared to the north location at 24.0% (p<0.05). Prevalence of DME was also significantly higher in the south location as compared to north (10.1% vs 6.9%; p < 0.05). Screening identified 272 patients requiring referral to an ophthalmologist or 14.9% (272/1830). 1558 patients (85.1%) did not need further examination until their next scheduled image. Overall capture rate was 65.4% (178/272). 91 of the remaining 94 either declined, already had an eye doctor, or were unable to be contacted.

In the ARC clinics, 3620 patients were screened over a 12 month period from September 2015 to 2016. Period prevalence of DR was 20.7% (750/3620). Ocular pathology including DR, AMD, and glaucoma, was detected in 33.4% (1209/3620). Prevalence and severity of DR and presence of DME is shown in Figure 1. Though there were differences in rates of DR or DME across the six sites, they did not meet statistical significance. 371 (10.2%) required urgent referral and of these, the capture rate was 65.5% (240/371). Therefore, 3249 patients (89.8%) did not need further examination until next scheduled image.

By combining the data from both sets of clinics a total 5,450 patients were screened. Prevalance was 22.7% (1236/5450). Overall prevalence of DME was 6.3%. The capture rate overall was 65.0% (418/643). There is a statistically significant difference in the period prevalence of diabetic retinopathy between the central health population and the private patients from the Austin Regional Clinic. (26.6% versus 20.7%, p<0.0002).

CONCLUSIONS

Overall, teleretinal screening for diabetic retinopathy at the point of care within a primary care physician’s office is an effective method of screening both well insured and underinsured patients who reside in an urban setting. A large majority of patients screened did not require further ophthalmology examination which may save patients from additional visits to the doctor potentially saving time and resources.

Our capture rate for patients requiring urgent referral is greater than previous reports in the literature. Direct contact from the reading center’s office to these patients immediately following identification of pathology is a likely contributing factor to increasing patient capture rate.

We detected differences in the prevalence of diabetic retinopathy in two distinct
patients: those with commercial or government insurance as compared to patients within the safety net populations. Factors leading to these differences warrants further study.

Strategic placement of cameras may help identify where diabetic disease with evidence of end organ damage is more prevalent. This information may be useful to epidemiologists, physicians, health regulators and other stakeholders who make decisions on allocations of health care resources.

REFERENCES


Figure 1: Location of Primary Care Locations within Central Texas where Patients are Screened for Diabetic Retinopathy Using the Teleretinal Imaging

Figure 2: Teleretinal Imaging Camera
Table 1: Prevalence of Diabetic Retinopathy and Diabetic Macular Edema in Primary Care Locations within Central Texas

<table>
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<th>Clinic</th>
<th>Location</th>
<th>None</th>
<th>Not Graded</th>
<th>Mild NPDR</th>
<th>Moderate NPDR</th>
<th>Severe NPDR</th>
<th>Proliferative DM</th>
<th>Total</th>
<th>Any DR/Predrome</th>
<th>Presence of DME</th>
<th>Presence of DME</th>
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<td>11</td>
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<td>301</td>
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DME: Diabetic Macular Edema
NPDR: Non-Proliferative Diabetic Retinopathy