

CLINICAL CASE REPORT

Remote eye care screening for rural veterans with Technology-based Eye Care Services: a quality improvement project

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ABSTRACT

Context: Veterans are at high risk for eye disease because of age and comorbid conditions. Access to eye care is challenging within the entire Veterans Hospital Administration's network of hospitals and clinics in the USA because it is the third busiest outpatient clinical service and growing at a rate of 9% per year.

Issue: Rural and highly rural veterans face many more barriers to accessing eye care because of distance, cost to travel, and difficulty finding care in the community as many live in medically underserved areas. Also, rural veterans may be diagnosed in later stages of eye disease than their non-rural counterparts due to lack of access to specialty care. In March 2015, Technology-based Eye Care Services (TECS) was launched from the Atlanta Veterans Affairs (VA) as a quality improvement project to provide eye screening services for rural veterans.

Lessons learned: By tracking multiple measures including demographic and access to care metrics, data shows that TECS significantly improved access to care, with 33% of veterans receiving same-day access and >98% of veterans receiving an appointment within 30 days of request. TECS also provided care to a significant percentage of homeless veterans, 10.6% of the patients screened. Finally, TECS reduced healthcare costs, saving the VA up to US\$148 per visit and approximately US\$52 per patient in round trip travel reimbursements when compared to completing a face-to-face exam at the medical center. Overall



savings to the VA system in this early phase of TECS totaled US\$288,400, about US\$41,200 per month. Other healthcare facilities may be able to use a similar protocol to extend care to at-risk patients.

Key words: access to care, cataract, diabetes, diabetic retinopathy, glaucoma, macular degeneration, ophthalmology, screening, tele-ophthalmology, telemedicine, USA.

Context

The world is a highly visual place and good vision is critical for people to perform activities of daily living such as working, driving, caring for themselves, and caring for others. Visually impaired individuals have greater morbidity and are more likely to become depressed or feel socially isolated¹⁻⁴. Eye disease is more common as people age⁵⁻⁸, so routine eye screening for disease is essential and should increase in frequency as a patient ages⁹. Routine screening results in early diagnosis, prompt treatment intervention, and prevention of visual impairment. However, as patients get older, they tend to seek eye care less regularly, right at the time in their life during which they are at greatest risk of visual impairment^{10,11}. In addition, older patients tend to live in more rural areas, and the rural patient is even less likely to have a comprehensive eye exam within the previous year compared to their urban counterparts^{12,13}. Rural patients face many barriers to obtaining eye care through the traditional eyecare delivery model (attending a face-to-face appointment at an eye clinic) due to several factors including distance to the clinic, need for transportation, cost for travel, and time to travel. Furthermore, since many rural areas are also medically underserved, it is conceivable that a rural elderly patient may be diagnosed with a potentially blinding ocular condition in the later stages of disease because they were unable to find a provider and obtain eye exams at the recommended interval.

The average veteran, rural or urban, is more vulnerable than the general US population for potentially blinding diseases because enrollees are older patients¹⁴, with an average age of 62, with 81.1% of enrollees greater than 50 years old¹⁴. Veteran is defined here as an individual who served in a

branch of the United States Armed Forces and qualifies for health care through Veterans Affairs (VA). The geriatric (age greater than 65 years) rural and medically underserved veteran population is growing, with increasing demand for services such as eye screening and glasses¹⁵. Currently, rural veterans desiring eye care need to travel to an eye clinic (ie either ophthalmology or optometry) to receive a face-to-face exam. This eyecare delivery method poses many barriers, listed earlier, that hinder the rural veteran from seeking routine eye care, which may have deleterious effects on their vision. To address the eyecare access needs of rural veterans, the Atlanta VA Eye Clinic piloted a new program called Technology-based Eye Care Services (TECS). This case report describes the early experience (March–September 2015) of TECS.

Issue

Case report

TECS is an ophthalmology–primary care store-and-forward, asynchronous, telemedicine partnership. It is designed to improve rural veterans' access to eyecare screening for common eye diseases: cataract, glaucoma, macular degeneration, and diabetic retinopathy (if the veteran is diabetic). Eyecare screening is provided in the rural primary care clinic, in a room measuring approximately 11 m² where an ophthalmology technician is permanently based. This room does not contain typical eye exam equipment (ie no slit lamp, no phoropter). Patients are referred to the program by onsite primary care providers or by self-referral. Technicians work up the patient by following a defined protocol. Screening questions are asked including a detailed ocular, family, and social history. Distance and near visual acuity,



refractive error (need for glasses) pupil reactivity, intraocular pressure and corneal thickness are measured. Pupils are dilated with 1% tropicamide in each eye. Fundus and external photos are obtained following a validated diabetic protocol (Fig1). The information is entered into an electronic health record. A physician located remotely at the main Atlanta VA Eye Clinic interprets the information collected, develops an assessment and plan, and prescribes eyeglasses if indicated. A letter is generated for each patient, informing them of the results of their eye screening exam. Those who require follow-up are called by eye clinic staff to schedule an appointment face to face in the timeframe specified by the reading physician.

The primary care clinic locations selected for this program are 74–166 km from the Atlanta VA Eye Clinic (Fig2).

Data obtained from this program formed the basis for a quality improvement/assurance project and thus information in this article is reported according to Standards for Quality Improvement Reporting Excellence guidelines¹⁶.

Several outcome measures were tracked for the program and the results of these metrics are fully reported elsewhere¹⁷. In this case report, demographic data, access to care, and cost data are reported specifically with regard to urban, rural, and highly rural veterans. Rurality, defined by Rural Urban Commuting Area (RUCA) codes¹⁸, was based on resident zip code and classified veterans as living in urban, rural, and highly rural areas. Patients making appointments for a TECS visit at one of the three community-based outpatient clinics were identified through the VA's corporate data warehouse, a standard database structure that incorporates data from multiple data sets throughout the VA to facilitate reporting and data analysis at the enterprise level. Using this data repository, appointment and visit information as well as demographic data were obtained for each patient using Microsoft SQL Server Management Studio. Once obtained, data was analyzed using Statistical Analysis Software v9.3 (SAS Institute; <http://www.sas.com>).

The TECS program provided eye care to a total of 1443 patients (approximately 206 eye exams per month). For the most part these veterans tended to be older than their urban counterparts. Moreover, a higher percentage of rural and highly rural veterans were classified as homeless (Table 1).

Table 2 shows TECS utilization by RUCA category. Out of 1816 appointments made to the TECS program during this time period, 102 (5.6%) did not show ('no show rate') and 271 (14.9%) cancelled, for a total non-attendance rate of 20.5%. More than 90% of the time, veterans' appointments were scheduled within 30 days of the day the request was made. Additionally, about 33% of veterans were seen on the same day they called the clinic for an appointment. Also, 78% of patients were scheduled on the exact date they desired their appointment. The ease in scheduling appointments becomes vital as one considers that 18.2% of these older rural veterans had no record of an eye exam at any VA in the past 5 years, compared to 10.3% of the urban veterans. Additionally, almost 5% of the rural and highly rural veterans who participated in the TECS program had not had an eye exam through the VA in the past 10 years compared to 0.8% of urban veterans (Table 2).

Out of the 1443 veterans who utilized the TECS program, 560 (38.8%) were referred for further evaluation because of possible glaucoma, age-related macular degeneration, diabetic retinopathy, and/or cataracts. This proportion is higher in rural veterans (40.8%) than in urban veterans (37.5%) (Table 3).

Veterans utilizing the TECS clinics saved time and money by driving less distance to their appointment (Table 4). Not measured in these data is the benefit to veterans utilizing TECS in reduced parking costs and driving stress by not driving into the metropolis, as the negative mileage and time savings found in the sample data indicate (Table 4).

Table 5 summarizes the VA's cost per veteran, on average, to provide routine screening eye care through different care delivery models.

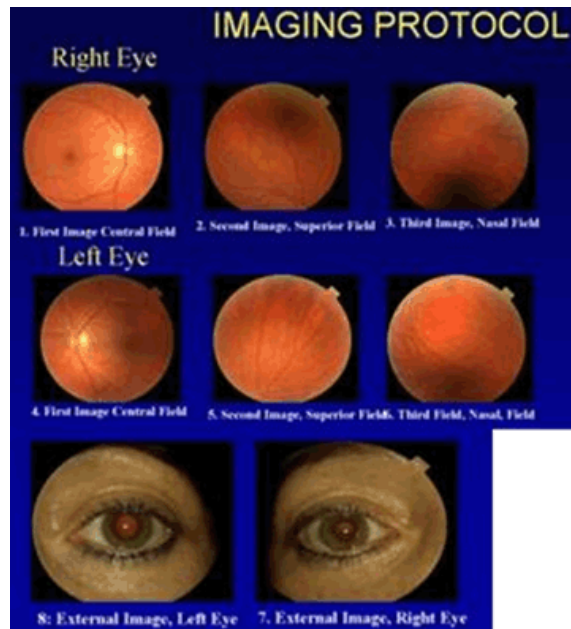


Figure 1: Fundus photography protocol.

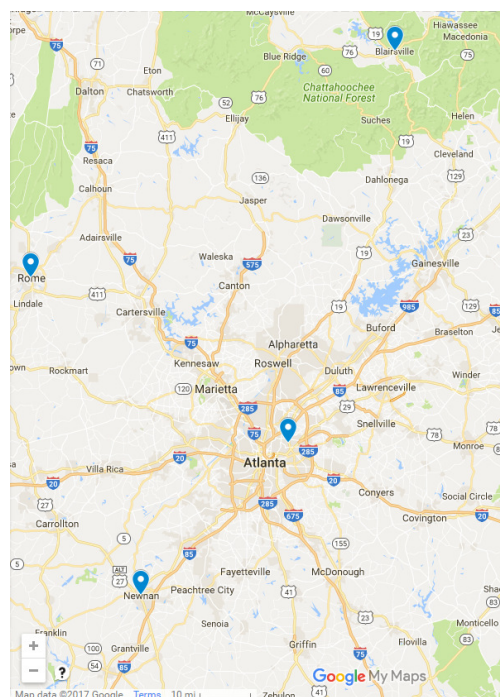


Figure 2: The three Technology-based Eye Care Services locations (Blairsville, Newnan, and Rome) and their geographic relationship with the main Atlanta Veterans Affairs Medical Center. (Image from GoogleMaps, My Maps)



Table 1: Characteristics of veterans receiving routine eye care through Technology-based Eye Care Services (March–September 2015)

Characteristic	Total	Urban	Rural	Highly rural
Sample size [†] (n, % of total)	1443	792 (55.9%)	595 (41.3%)	55 (3.8%)
Age (mean ± SD)				
Female	51.1 ± 10.9	50.3 ± 10.6	52.8 ± 11.6	50.5 ± 7.8
Male	64.7 ± 11.4	63.6 ± 11.7	65.7 ± 11.3	68.7 ± 8.1
Gender (n)				
Female	115	75	38	2
Male	1328	717	557	53
Race (n)				
Non-Hispanic White	963	442	472	48
Non-Hispanic Black	361	290	71	0
Hispanic	21	17	4	0
Other	22	11	10	1
Unknown	76	32	38	6
Operation Enduring Freedom/Operation Iraqi Freedom				
All patients (n)	93	64	29	0
Female patients (n)	17	13	4	0
Male patients (n)	76	51	25	0
Disabled				
All patients (n)	458	259	199	0
Homeless [‡]				
All patients (n)	153	73	69	11
Female patients (n)	13	7	6	0
Male patients (n)	140	66	63	11
Years at Veterans Affairs (mean ± SD)				
Female patients	6.5 ± 5.0	6.8 ± 5.1	5.8 ± 4.8	9.0 ± 7.1
Male patients	8.1 ± 5.2	8.0 ± 5.3	8.2 ± 5.2	8.6 ± 5.0

[†] Rural Urban Commuting Area could not be classified for one patient due to missing zip code.

[‡] Defined as having a stop code of 522, 528, 529, 530, 590 or International Classification of Diseases-9 code of V60.0, V60.1 within the past 5 years.
SD, standard deviation

Table 2: Veterans' utilization of Technology-based Eye Care Services program by Rural Urban Commuting Area category (March–September 2015)

Utilization and wait times	Total (N=1443)	Urban (N=792)	Rural (N=595)	Highly rural (N=55)
Appointments and visits				
Appointments made	1816	994	756	65
Veterans seen	1443	792	595	55
No show	102	56	44	2
Cancellations	271	146	117	8
Wait time from date called (n, % [†])				
0 days	472 (32.7%)	275 (34.7%)	188 (31.7%)	9 (16.4%)
1–14 days	882 (61.3%)	483 (60.9%)	362 (60.9%)	36 (65.5%)
15–30 days	71 (4.9%)	31 (3.9%)	32 (5.4%)	8 (14.6%)
>30 days	18 (1.3%)	4 (0.5%)	12 (2.0%)	2 (3.6%)
Wait time from date desired (n, % [†])	n=1414	n=782	n=577	n=54
0 days	1103 (78.0%)	627 (80.2%)	444 (77.1%)	30 (55.6%)
1–14 days	301 (21.3%)	152 (19.4%)	126 (21.9%)	23 (42.6%)
15–30 days	9 (0.6%)	3 (0.4%)	5 (0.9%)	1 (1.9%)
>30 days	1 (0.1%)	0	1 (0.2%)	0
Last eye exam within Veterans Affairs (n, % [†])				
>5 years [‡] (n=816)	110 (13.5%)	46 (10.3%)	61 (18.2%)	3 (9.1%)
>10 years [§] (n=463)	12 (2.6%)	2 (0.8%)	9 (4.7%)	1 (4.8%)

[†] Percentage of population or subpopulation as per column specification.

[‡] Includes only patients who have been utilizing the Veterans Affairs Eye Clinic for more than 5 years.

[§] Includes only patients who have been utilizing the Veterans Affairs Eye Clinic for more than 10 years.



Table 3: Diagnoses resulting from Technology-based Eye Care Services visit by Rural Urban Commuting Area category (March–September 2015)

Diagnosis	Total (N=1443)	Urban (N=792)	Rural (N=595)	Highly rural (N=55)
Glaucoma	230 (15.9%)	133 (16.8%)	92 (15.5%)	5 (9.1%)
Suspect (C:D or pressure) (365.0x)	208	120	83	5
Open angle (365.1x)	16	10	6	0
Narrow angle (365.2x)	1	0	1	0
Other not in the above	10	7	3	0
Age-related macular degeneration	67 (4.6%)	22 (2.8%)	37(6.2%)	8 (14.6%)
Dry (365.50, 365.51)	63	20	35	8
Wet (365.52)	5	3	2	–
Diabetes no retinopathy	431 (29.9%)	218 (27.5%)	200 (33.6%)	13 (23.6%)
Diabetic retinopathy	75 (5.2%)	38 (4.8%)	33 (5.5%)	4 (7.3%)
Proliferative (362.02)	8	4	4	
Severe non-proliferative (362.06)	7	2	5	
Moderate non-proliferative (362.05)	12	1	10	1
Mild non-proliferative (362.04)	34	20	12	2
Macular edema (362.07)	8	3	5	
Unspecified (362.01, 362.03)	15	10	4	1
Cataracts	267 (18.5%)	143 (18.1%)	117 (19.6%)	7 (12.7%)
Eye condition suspected	560 (38.8%)	297 (37.5%)	243 (40.8%)	20 (36.4%)

Table 4: Mileage[†] and cost savings for veterans utilizing the Technology-based Eye Care Services program at community-based outpatient clinic compared to receiving eye exam at Atlanta Veterans Affairs Eye Clinic (March–September 2015)

Mileage and cost savings	Total (n=144)	Blairsville (n=31)	Rome (n=41)	Newnan (n=72)
Distance from CBOC to Atlanta VAMC		165.8 km	116.5 km	73.7 km
Travel distance, round trip (km)				
To CBOC (mean ± SD)	66.3 ± 55.2	98.7 ± 54.4	65.8 ± 39.8	52.6 ± 49.9
To Atlanta VAMC (mean ± SD)	210.5 ± 79.7	301.1 ± 67.9	224.3 ± 52.0	163.7 ± 58.3
Travel distance saved (mean ± SD)	144.4 ± 77.2	202.6 ± 96.3	158.5 ± 74.4	111.2 ± 48.1
Driving time, round trip (min)				
To CBOC (mean ± SD)	51.3 ± 32.9	71.2 ± 39.0	52.1 ± 27.9	42.3 ± 28.9
To Atlanta VAMC (mean ± SD)	136.2 ± 47.8	194.5 ± 44.5	144.1 ± 29.2	106.6 ± 29.5
Driving time saved (mean ± SD)	84.9 ± 48.9	123.4 ± 64.3	92.0 ± 45.0	64.3 ± 28.7
Average travel costs savings per veteran (US\$0.359 per km [‡])	\$52 ± \$28	\$72 ± \$34	\$57 ± \$27	\$40 ± \$17
Average time costs savings per veteran (US\$23.21 per hour [§])	\$32 ± \$19	\$48 ± \$25	\$36 ± \$17	\$24 ± \$11

[†] Based on a 10% random sample for each CBOC. Driving distance and time data obtained from www.google.com/maps. First recommended route (shortest) and time without traffic was used. If veteran's address was not useable (post office box or exact match not found), then an address for another veteran at the same CBOC was randomly selected.

[‡] Based on General Services Administration privately owned vehicle mileage reimbursement rates for federal employees for 2015 financial year.

[§] Based on Bureau of Labor Statistics, US Department of Labor, 'Occupational employment and wages in Atlanta-Sandy Springs-Marietta, May 2013', news release, 8 May 2014.

CBOC, community-based outpatient clinic. SD, standard deviation. VAMC, Veterans Affairs Medical Center/Eye Clinic.



Table 5: Veterans Affairs cost per veteran to receive routine eye screening exam

Provider	Total cost (direct and indirect)
Atlanta Veterans Affairs main eye clinic (Decatur)	US\$291
Eye provider at primary care clinic	US\$251
Veterans' Choice program	US\$173
Technology-based Eye Care Services sites	US\$143

Lessons learned

TECS reduced healthcare disparities by providing care for two underserved groups: the rural and highly rural patient, and the homeless patient. Of the veterans served by TECS, a high percentage of the rural and highly rural patients were non-Hispanic white. This finding was consistent with national data where whites are more likely to live in rural areas^{19,20}. TECS also served a proportion of homeless veterans, with the largest percentage of homeless being highly rural veterans. In addition, compared to urban patients, a higher percentage of rural veterans had been without eye care for more than 5 years. It is not surprising, therefore, that the percentage of eye disease diagnosed in rural and highly rural veterans was higher in some categories, for example, age-related macular degeneration. This is one of the most common causes of vision loss in the USA. TECS, through improving access, may help prevent blindness by identifying the disease early, which enables initiation of preventative vitamin therapy^{21,22}.

TECS also provided specialty eye care for many homeless veterans. According to statistics of the US Census Bureau, the rate of poverty is highest in rural America²³; importantly, 20.0% of highly rural patients served by TECS were classified as homeless.

One of the major goals of TECS was timely access to eye care. The data demonstrate that TECS was highly successful in giving timely access to care for all veterans entering the program. More than 90% of patients received an appointment within 14 days of their desired date, defined as the date between when the patient wanted his/her appointment and the date of the actual appointment. Also,

33% of patients received an eye appointment on the same day they called to schedule their appointment.

Finally, TECS helped mitigate the barriers of travel distance, time and cost for rural and highly rural veterans. Veterans saved, on average, 145 km of driving distance and 85 minutes of driving time by obtaining eye care at their community-based outpatient clinic instead of at the main eye clinic. This translated to savings for the VA system of approximately US\$52 per patient from mileage reimbursements alone. The total non-attendance rate (no show plus cancellations) of approximately 20% in the TECS program was lower than the total non-attendance rate at the main eye clinic.

TECS is a novel remote eyecare screening initiative that was begun by the Atlanta VA Eye Clinic in an effort to improve access to routine eye care, especially for rural and highly rural veterans. In its inaugural months, TECS has successfully provided improved access to not only rural and highly rural veterans but also homeless veterans. This program has saved veterans time and money, and possibly reduced cost to the VA system – about US\$200 per patient for a total of US\$288,000 in less than 1 year. TECS represents a remote health innovation that may help address the visual needs of rural or disadvantaged patients by providing specialty eyecare access through the primary medical care home. It is a screening program that focuses on maintaining a patient's visual health and preventing blindness.

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