

PICTURES OF NORTH AMERICA

Teleophthalmology in three settings.

The Veterans Health Administration

BY MARY LYNCH, MD



In 2016, the Veterans Health Administration (VA) cared for more than 6 million veterans in 168 medical centers. Over 34% of these patients lived in rural or highly rural communities. To bring health care closer to where veterans live, community clinics have been built surrounding each of the medical centers. Some community clinics are more

than 100 miles away from the main medical center. For the most part, these community clinics provide primary care and mental health.

In 2006, the VA began to put retinal cameras in the community clinics for diabetic screening. Telehealth technicians capture retinal images, which are remotely interpreted by an eye care provider in a centralized reading center. Patients with suspicious findings are referred for an ophthalmic evaluation. For many patients seen in the teleretinal screening clinics, distance and geography have prevented them from seeking ophthalmic care at the medical centers. The Diabetic Teleretinal Program has improved the delivery of preventive screenings to veterans, with approximately 90% of diabetic patients evaluated on a regular basis nationally.

Eye care in the VA is growing at a steady rate, with an increase in patient visits of 3.4% per year. Some states, like Georgia, are growing more rapidly than the rest of the country. For instance, the Atlanta Eye Clinic has grown at an annual rate of nearly 13% for several years. The unsustainable growth rate and its impact on access became a very public issue in 2014, when it became clear that veterans were being placed on waiting lists to enter the system. To deal with the problem effectively, the VA had to develop new ways of delivering care.

FROM SILOS TO A SPECTRUM

For decades, the VA has operated on a silo model of eye care delivery: ophthalmology and optometry operate as two separate programs. Recently, however, the VA began looking

at eye care as a spectrum of needs (Figure 1). Basic eye care includes screening and eyeglasses. Intermediate care involves testing to determine if disease exists and the management of ocular conditions in their early stages. Advanced eye care consists of managing serious, high-risk, unstable conditions and surgery. With this new approach, the VA can target resources to a specific level of care. After all, the resources needed for basic eye care are not the same as those required for advanced care.



AT A GLANCE

- Eye care in the Veterans Health Administration (VA) is growing at an unsustainable rate, negatively affecting veterans' access to treatment. To deal with the problem, the VA began looking at eye care as a spectrum of needs. In 2015, the VA expanded the teleretinal imaging protocol into a teleophthalmology system called Technology-based Eye Care Services.
- Managing the eye care of the Native Americans of the Navajo Nation presents many logistical problems. The John A. Moran Eye Center at the University of Utah is working to bridge these barriers. With telemedicine, physician assistants and nurses can transmit slit-lamp and fundus photographs to remote readers for help with diagnosis, treatment, and a decision on the need for a referral.
- In education, teleophthalmology can provide students and trainees with access to peers and faculty at remote locations and at times when direct physical interaction may not be possible. New Jersey Medical School established a teleophthalmology community outreach program in 2005. It has provided access to specialized ophthalmology care to more than 4,800 people at homeless shelters, soup kitchens, and community centers in the state.

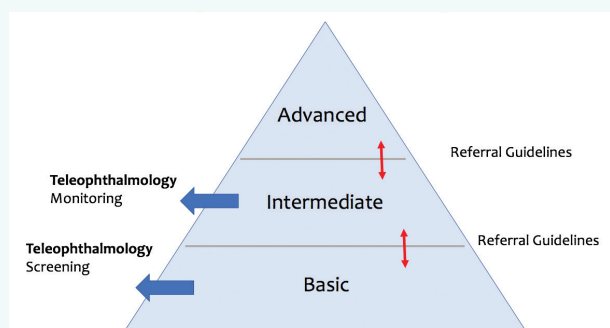


Figure 1. VA spectrum model of eye care.

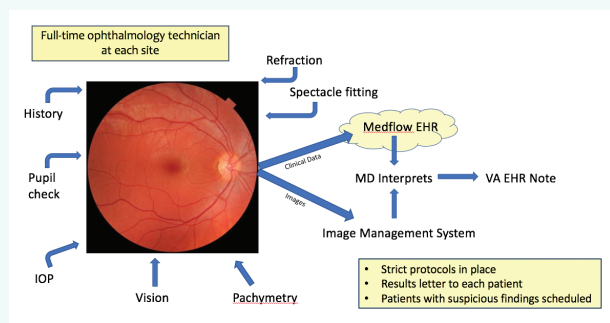


Figure 2. Technology-based Eye Care Services.

Abbreviation: EHR, electronic health record.

EXPANSION

In 2015, the VA expanded the teleretinal imaging protocol into a teleophthalmology system called Technology-based Eye Care Services (TECS; Figure 2). Developed by April Maa, MD, at the Atlanta VA, TECS has been implemented at several other VA hospitals. With TECS, instead of an imaging technician's conducting the screening, a full-time ophthalmology technician is stationed at a rural primary care clinic with an automated subjective refractor, visual acuity chart, tonometer, pachymeter, and devices for external and fundus photography. He or she uploads the clinical data into the electronic health record. A provider then reviews all of the information and completes the chart note. When appropriate, glasses are ordered. Strict protocols are in place for both technicians and readers. Patients with suspicious findings are scheduled to visit the eye clinic for a face-to-face examination.

Since March 2015, more than 6,000 veterans have been served. An average of 90 miles of travel is saved per patient. The eyeglass remake rate for TECS equals that of the main eye clinic. More than 20% of the veterans had had no eye exam in more than 5 years.¹

Thirty-six percent of the patients screened have had a suspicious finding and were scheduled for examination at the eye clinic. The most common concerns were possible glaucoma, cataract, diabetic retinopathy, and age-related

macular degeneration. With a tentative diagnosis, all ancillary testing can be prescheduled, including visual fields and tomography. This has increased clinic efficiency. More than 50% of the patients referred from TECS are diagnosed with a new, significant eye disease of which they were unaware.¹

With TECS, basic services have moved out of the main medical center and into the community clinics. The shift has freed up the eye clinic for intermediate and advanced care. TECS has also identified a number of patients with serious eye conditions who were unaware of their situation. It is possible that some intermediate care (eg, monitoring patients at risk of developing glaucoma) could also be delivered through a technology-based clinic. It is not hard to imagine adding a visual field machine and an optic nerve analyzer to the TECS diagnostic capability.

CONCLUSION

During the past few years, the VA has been forced to rethink how health care is delivered. TECS has been a step forward for veterans that has improved their access to care, the detection of sight-threatening conditions, clinical efficiency, and resource allocation.

1. Maa AY, Wojciechowski B, Hunt KJ, et al. Early experience with technology-based eye care services (TECS): a novel ophthalmologic telemedicine initiative. *Ophthalmology*. 2017;124:539-546.

Mary Lynch, MD

- VHA VISN 7 ophthalmology consultant
- professor, Emory University School of Medicine, Atlanta
- (404) 329-2216; mary.lynch4@va.gov

The Navajo Nation

BY ALAN S. CRANDALL, MD



Teleophthalmology has been of value in the developing world, with successful programs in Nepal (Himalayan Cataract Project Tilganga) and India (Aravind Eye Care System). In large areas of both countries, no ophthalmology care is available. At the Aravind hospitals, one faculty member mans the telemedicine portal for a week; the system also serves several clinics with a physician assistant (PA) or nurse but no doctor.

In North America, managing the eye care of the Native Americans of the Navajo Nation presents many logistical problems. A major challenge is the size of the territory and population—25,000 square miles and 173,000 people (Figure). Additional obstacles are the rugged, dirt

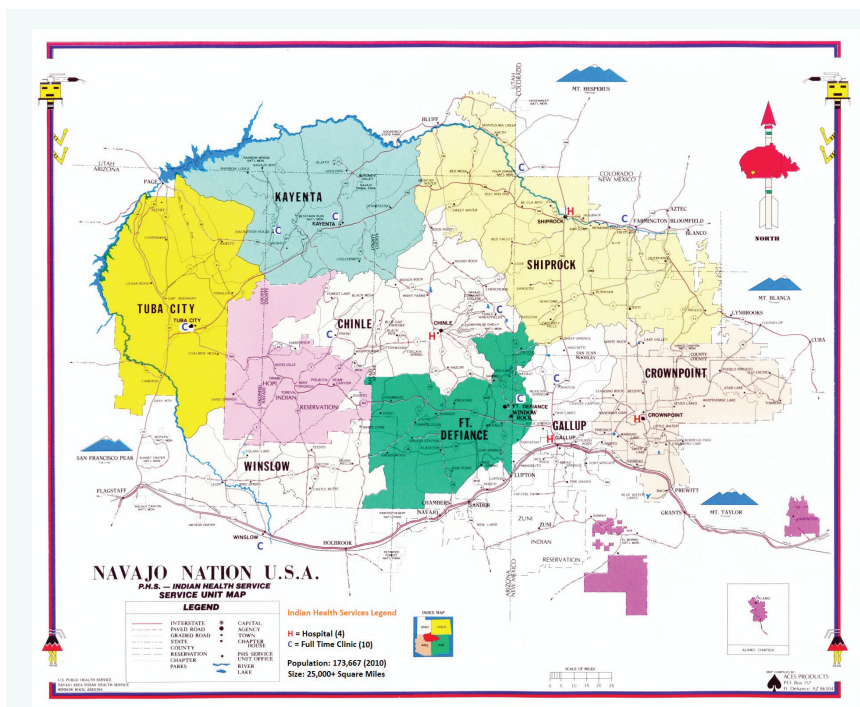


Figure. The territory of the Navajo Nation covers 25,000 square miles and spans Utah, Colorado, Arizona, and New Mexico.

“road system” that becomes difficult to travel in inclement weather and the great distances between the 10 clinics and the four hospitals. No ophthalmologists live or work on the reservation, but there is an optometrist in Blanding, Utah. Visiting the office can be very difficult for patients, because they must travel so far.

Moreover, the Nation includes the Hopi and the Zuni tribes, and the reservation spans four states: Utah, Colorado, Arizona, and New Mexico (the Four Corners). Either the medical practitioner must have a state license for each state where he or she delivers care, or the patient must travel to the provider’s state, which can hamper access, as mentioned earlier. In addition, whereas a Medicare patient may access any facility that serves Medicare patients, Native Americans must use certain clinics within their systems.

The John A. Moran Eye Center at the University of Utah is working to bridge these barriers. The center sends a team to the reservation once a month. One or two surgeons travel to Blue Mountain Hospital in Blanding, while the rest of the team sets up clinics in at least two areas, usually located within a 2-hour drive but sometimes within 4 hours.

THE ROLE OF TELEMEDICINE

The goal of telemedicine is to help identify patients who need to be seen in person and to determine who requires surgery or laser therapy. The types of medical problems encountered in Native American populations highlight the

value of telemedicine for these patients. A significant number of Native Americans have diabetes. Also common in this population are hypertension, glaucoma, cataracts, and significant refractive errors (high myopia and large amount of astigmatism).

With telemedicine, patients can be seen at a local clinic that has slit lamps by a trained PA or nurse, who can transmit photographs of the front of the eye to a reader. These medical professionals can also perform pupillary dilation and take and transmit fundus photographs, which are particularly helpful for staging retinopathy. The presence of hypertensive retinopathy assists the local caregiver in deciding how aggressive to be about treatment; laser therapy can be scheduled and transportation arranged as needed. Also valuable is the remote evaluation of the optic nerve, which facilitates the diagnosis of glaucoma as well as the monitoring of treatment. If patients present with foreign bodies in the cor-

nea or infections such as herpes simplex or zoster, a remote physician can help to decide when a referral is needed and when treatment may be delivered locally.

Unfortunately, long distances to travel and trouble finding rides often delay therapy (eg, if a laser is not available on site) and follow-up care.

CONCLUSION

Telemedicine has great potential for the Navajo Nation. It is to be hoped that technological advances will provide access to scans and biometry, which could be used, for example, to ensure that the correct IOL powers are available when patients are able to travel to a hospital.

It is important to understand and be sensitive to local needs and to patients’ concerns about the transmission of private information. The staff at the Moran Eye Center hopes to train Native American PAs and nurses and to partner with them to deliver the best care in a respectful and considerate manner.

Alan S. Crandall, MD

- John A. Moran presidential professor; John E. and Marva M. Warnock presidential endowed chair; senior vice chair; director of glaucoma and cataract; and director, Moran Outreach Division, John A. Moran Eye Center, University of Utah, Salt Lake City
- (801) 585-3071; alan.crandall@hsc.utah.edu

Academia

BY ALBERT S. KHOURI, MD, AND BEN SZIRTH, PhD



In its most inclusive definition, teleophthalmology consists of any exchange of digital information that enhances patients' care. In education, it can provide students and trainees with access to peers and faculty at remote loca-

tions and at times when direct physical interaction may not be possible. For example, an ophthalmology resident at the beginning of training may need to evaluate patients while on call in the emergency department and may not have access to faculty or fellow residents who are located at a separate location across campus. Teleophthalmology can overcome such barriers by allowing the resident to receive peer-to-peer advice from fellow residents and diagnostic and management recommendations from faculty members.

ADVANTAGES AND PITFALLS

Teleophthalmology can allow physicians to communicate effectively, and it has the potential to improve the quality of education and expedite patients' care. The eye lends itself particularly well to imaging and the ability to share ocular images can provide a more accurate description of pathology than a verbal or written descriptive communication. By sharing an optic nerve image depicting a rim notch with corresponding retinal nerve fiber loss on optical coherence tomography (OCT), a resident on call is more likely to confirm the diagnosis of glaucoma than if he or she verbally describes findings over the phone to an attending physician.

Of course, there are pitfalls and a vast opportunity for improvement in this area. Although devices can be password protected, messages encrypted, and networks secured, the trail of images and embedded protected health information can pose security risks (eg, text message images remaining in chat trails or in a cell phone's memory). The use of non-Digital Imaging and Communications in Medicine means of transmission raises concerns related to the Health Insurance Portability and Accountability Act for patients, physicians, and the health care system.

In addition, the quality and resolution of images can vary widely among various smart devices. In a pilot study presented at the 2016 annual meeting of The Association for Research in Vision and Ophthalmology, successful and high-quality images were acquired with smartphones for use in teleophthalmology at a training program. Variable image quality highlighted the need for standards and raised awareness of the pitfalls of relying on nonvalidated emerging trends in smartphone imaging.¹ In that sense, there is a need to develop secure, high-quality



Figure 1. Medical students during a teleophthalmology community outreach event.

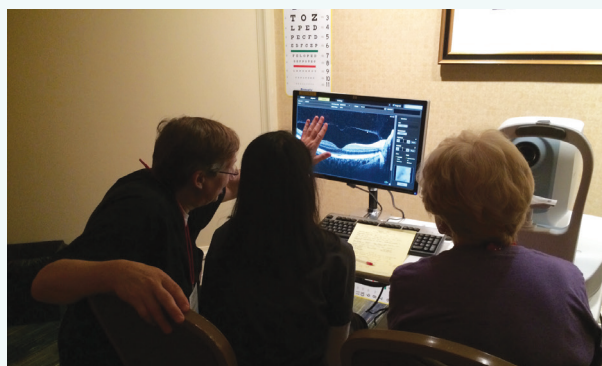


Figure 2. Interpretation of findings obtained during teleophthalmology.

systems for teleophthalmology that can positively affect the quality of training by increasing residents' connectivity and give them access to real-time feedback. This, in turn, could positively influence patients' care and improve their safety.

MEDICAL SCHOOL COMMUNITY OUTREACH

The teleophthalmology community outreach program at New Jersey Medical School was established in 2005. It relies on the service of volunteer medical students to organize community events (Figures 1 and 2). This involves the transport and assembly of teleophthalmology equipment for the screening of people. The goal is to provide access to ophthalmology for individuals across the state who have vision-threatening diseases like glaucoma. Patients with eye diseases receive recommendations and are referred to the university for care.

The program has provided access to specialized ophthalmology care to more than 4,800 people at homeless shelters, soup kitchens, and community centers in New Jersey. Medical students have an excellent opportunity to give back to their community while gaining useful skills and exposure to technology (subjects are evaluated with digital high-resolution cameras and portable OCT devices). Teams of

(Continued on page 39)

(Continued from page 37)

students, technicians, and physicians provide comprehensive examinations through protocols that the teleophthalmology program has developed over the past decade.²

RESEARCH

The rapidly evolving technologies upon which teleophthalmology relies (digital nonmydriatic imaging, portable functional testing, OCT, etc.) offer exciting translational research opportunities for students, residents, and faculty. There is also a gap in knowledge of standardized procedures and best practices for teleophthalmology. The lack of developed and defined standards presents an opportunity for medical students, residents, and faculty to become involved in research within the field. For example, compared with diabetic retinopathy, glaucoma lacks standardized protocols for telemedicine. The ongoing NJ Health Foundation Tele-Glaucoma trial presents research opportunities for the students, residents, and faculty at New Jersey Medical School.^{3,4} Imaging, artificial intelligence, software/hardware solutions, and algorithm applications continue to evolve thorough collaborative research in teleophthalmology.

CONCLUSION

As a field, ophthalmology frequently relies on pattern recognition, and it is amenable to imaging. The role of teleophthalmology in academic medicine will continue to expand as technological capabilities grow, but it requires the development of standards of care. Telepresence is teleophthalmology applied in real time. Used properly for screenings and consultations, telepresence will provide instantaneous feedback to physicians in training and real-time recommendations to patients. The impact on the quality of education and patients' care could be significant. ■

1. Xia T, Szirth B, Khouri A. Anterior segment smartphone imaging quality in telemedicine. *Invest Ophthalmol Vis Sci*. 2016;57:ARVO e-Abstract 5930.

2. Kolomeyer AM, Szirth BC, Shahada KS, et al. Software-assisted analysis during ocular health screening. *Telemed J E Health* 2013;19(1):2-6.

3. Kandl T, Huang L, Szirth B, Khouri A. Telepresence with multimedia solutions during ophthalmology residency. *Invest Ophthalmol Vis Sci*. 2013;54:ARVO e-abstract 2315.

4. Mendez N, Kommana S, Szirth B, Khouri A. Glaucoma telemedicine versus conventional care: New Jersey Health Foundation prospective clinical trial. Paper presented at: AAO Annual Meeting; October 16-18, 2016; Chicago, IL.

Albert S. Khouri, MD

- associate professor and program director of the ophthalmology residency as well as director of the Glaucoma Division at Rutgers New Jersey Medical School in Newark, New Jersey
- (973) 972-2045; albert.khouri@rutgers.edu
- financial disclosure: grant support from New Jersey Health Foundation

Ben Szirth, PhD

- director of applied vision research and ophthalmic telemedicine, Rutgers New Jersey Medical School, Newark, New Jersey
- financial interest: none acknowledged