

TELEOPHTHALMOLOGY TRAVELS GREAT DISTANCES IN CANADA



Telemedicine programs bring ophthalmic care to remote populations and others who lack access.

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Canada is the second largest country in the world, with a population of only 36 million people. Many Canadians live in remote communities at great distances from large urban centers. Although indigenous patients (Inuit, Metis, and First Nations) are found in metropolitan areas, a large proportion of them live on ancestral homelands in small rural communities distributed across central and northern Canada. Despite access to universal health care, those living in remote communities face barriers to eye care due to geography and the costs and difficulties of travel.

Canadians living in the large cities may also face barriers to specialty eye care. For many living in inner cities, access may be difficult due to social isolation, lack of education, the requirements of full-time work, or lack of a family doctor.

Canada has fewer ophthalmologists per patient population compared with the United States. There are 3.35 ophthalmologists per 100,000 population in Canada,¹ compared with 5.7 ophthalmologists per 100,000 in the United States.² There is also significant regional disparity, with most ophthalmologists based in large urban centers.¹

TELEOPHTHALMOLOGY PILOTS

The prevalence of diabetes in Canada is 6.9%,³ affecting 3.7 million people.⁴ The incidence is higher in indigenous Canadians, with rates of 25% to 40% reported.⁵ Because many of these individuals are located in remote communities, programs to improve access have been created. The advent of digital photography in the mid-1990s led to the development of Canadian teleophthalmology pilot projects.⁶⁻⁸

In these programs, using store-and-forward technology, trained ophthalmic photographers would capture anterior segment and retinal

photographs while trained technicians would record medical history, visual acuity, and intraocular pressure. Access to high-speed internet in most communities across Canada allowed secure web-based sharing of information.

GOVERNMENT SUPPORT

All Canadians are supposed to have universal access to health care, regardless of geographic location. Provincial governments fund health care, and the federal government funds health care-related travel and accommodations for most indigenous people. Government funding agencies look with favor upon tools that improve

AT A GLANCE

- ▶ Teleophthalmology can alleviate travel burdens, saving patients and medical systems time and money.
- ▶ It can improve access for at-risk populations by providing direct access to ophthalmic care from a distance.
- ▶ Teleophthalmology programs can also support research efforts.



Figure. In the winter, many communities in Northern Canada are accessible only by ice-roads.

access to and quality of health care while reducing overall costs. Canadian teleophthalmology programs have expanded and multiplied over time with stable government funding. This funding has supported the purchase of equipment, the salaries of photographers and nurses who perform teleophthalmology examinations, and the fees for physician graders.

Physicians performing clinical assessments via telemedicine must be licensed in the province where the patient is remotely assessed. Liability coverage for examinations by telemedicine is provided by the Canadian Medical Protective Association under the umbrella of medical care.

CLINICAL VALIDATION

Canadian validation studies have prospectively established that high-resolution stereoscopic digital images of the macula are as sensitive and specific as contact lens biomicroscopy in the diagnosis of clinically significant macular edema.⁹ Furthermore, Canadian research has shown that high-resolution stereoscopic digital imaging of standard fields 1 and 2, with monoscopic imaging of standard fields 3 through 7, is equivalent to standard ETDRS stereoscopic film for grading diabetic retinopathy (DR).¹⁰ Two 45° images centered on the disc

and macula have also been shown to be equivalent to the seven standard stereoscopic 30° ETDRS images.¹¹

PROGRAMS

Diabetic Retinopathy

Most teleophthalmology programs in Canada focus on screening for DR. Teleophthalmology programs for DR have been successfully established in multiple remote capture locations, including pharmacies, optometrists' offices, rural hospitals, and health centers on reserves across Canada.^{7,12,13} These programs are facilitated by government funding and advocated for by the Canadian Ophthalmology Society.¹⁴

Regional Programs

Most provinces and territories in Canada support regional teleophthalmology programs. These programs link small regional hospitals to large urban centers in a spoke-and-hub model. Patients with diabetes are referred by their family doctors for retinal photographs, intraocular pressure measurements, visual acuity testing, and short medical histories. The retinal images and clinical data are then uploaded onto a secure website for review by an ophthalmologist, and patients with vision-threatening diseases are referred accordingly.

The teleophthalmology program in Edson, Alberta, demonstrates some of the benefits of these programs. The prevalence of DR was found to be 27.2%, and 299 of 394 patients (75.9%) were assessed with teleophthalmology alone, not requiring referral. This saved patients 1881 hours and 180.096 km of travel time.¹⁹

Programs for Indigenous Communities

Many indigenous communities in Northern Canada do not have year-round road access. Instead, these communities are accessible by plane or boat in the summer and by ice-road in the winter (Figure). Many indigenous people have diabetes. To reach them for teleophthalmologic care, mobile camera units travel by truck, boat, or plane to health centers on reserves with a trained technician.

An example of such a mobile program is the Screening for Limb, I (Eye), Cardiovascular, and Kidney (SLICK) complications program that was established to screen patients with type 2 diabetes in 44 First Nations communities throughout Alberta. The SLICK program provides First Nations communities with screening for complications of diabetes and with education and counseling.¹⁵ Culturally sensitive programs such as SLICK have been shown to improve attendance and patient satisfaction.¹⁶ Established teleophthalmology programs have also been used to investigate risk factors for progression of DR in First Nations communities.¹⁷

Inner City Programs

Teleophthalmology programs have been integrated into urban centers throughout Canada with retinal cameras based in pharmacies. Of the patients with diabetes screened through this program, 38% had never had a dilated eye examination, and an additional 30% had not had an eye examination for more than 2 years. The program was efficient, given that 85.6% of patients did not require

VISION FACTS: CANADA

- More than 5.5 million Canadians have a major eye disease that could lead to vision loss.
- An estimated 1.4 million Canadians have AMD, which is the leading cause of vision loss in the country.
- Other significant causes of vision loss include diabetic retinopathy, glaucoma, cataracts, and refractive error.
- The prevalence of vision loss in Canada is expected to increase by nearly 30% in the next 10 years.

Source: Canadian National Institute for the Blind.
Fast facts about vision loss.
www.cnib.ca/en/about/media/vision-loss/pages/default.aspx. Accessed February 5, 2018.

in-person assessment, and effective in that it identified patients (2%) who required urgent ophthalmic assessment and treatment.⁸

Age-Related Macular Degeneration

Age-related macular degeneration (AMD) is the leading cause of irreversible vision loss in Canada.¹⁸ Many patients present in late stages of disease because they have not had annual eye examinations. Teleophthalmology improves early identification of treatable disease and streamlines treatment once patients are diagnosed.

Canadian researchers demonstrated that teleophthalmology units in small communities can be used for screening and follow-up monitoring of patients with wet AMD. The program improved early diagnosis of treatable AMD and confirmed identification of recurrent disease activity in eyes with previously inactive wet AMD.¹⁹

Optometry Programs

Teleophthalmology can facilitate retina-related optometric referrals. In Alberta, most optometry group practices are linked directly to retina specialists via teleophthalmology. Retinal photographs and optical coherence tomography images can be uploaded to a secure website for review by a retina specialist. Benefits of the program include reduced need for in-person examination by a retina specialist and improved eye

testing and treatment processes.¹²

As an example, a person who is diagnosed with wet AMD via teleophthalmology at an optometrist's office can easily be referred to a retina specialist, who can then arrange for fluorescein

angiography and optical coherence tomography imaging to be performed upon the patient's arrival. The retina specialist can then review the tests, examine the patient, confirm the diagnosis, and, if needed, treat the patient in a single visit. In a country where patients may need to travel more than 1000 km to see a retina specialist, such an improvement in efficiency is vital.

One study showed that, with this type of teleophthalmology program, 48% of patients were able to avoid an in-office consultation.¹² In addition, advance booking of the appropriate ancillary tests reduced the total number of visits necessary to assess retinal problems; nearly all patients underwent same-day testing and treatment. The total travel savings were 24,413.99 km and 259.09 hours for the entire study cohort, and average travel savings of 301.41 km and 3.64 hours for patients who could be assessed by teleophthalmology alone.¹²

Hereditary Retinopathies

Teleophthalmology can be used to bring multiple specialists together to assess patients with hereditary

retinopathies. A geneticist, electrophysiologist, and retina specialist can review clinical history, retinal photographs, and electrophysiologic data, including full-field electroretinogram and/or multifocal electroretinogram, via a secure website at the University of Alberta in Edmonton. Each specialist is able to comment on the diagnostic results and clinical findings, and a summary report can be generated.

To date, this service has provided diagnostic assistance to more than 1500 patients with genetic diseases of the retina, with a total of more than 2000 teleophthalmology assessments.

BENEFITS

Teleophthalmology can alleviate travel burdens, saving patients and medical systems time and money. As discussed above, teleophthalmology DR screening programs can significantly reduce the need for in-person assessments, patient time, and travel burden.²⁰ Applying teleophthalmology to optometric referrals to retina specialists reduced the number of required in-person visits by 48%.¹² Teleophthalmology can also be tailored to optimally address at-risk populations through culturally sensitive methodologies.

Economic benefits can result from the use of teleophthalmology. Compared with in-person assessment, a teleophthalmology program serving an isolated First Nations community in Ontario demonstrated significant savings per sight-year and quality-adjusted life year.²¹ In Manitoba, an average savings of \$1007 per teleophthalmologic examination has been seen, compared with clinic visits.²²

Established teleophthalmology programs lend themselves to research. Canadian teleophthalmology programs have been used to investigate the prevalence of DR and risk factors for its progression.^{17,20}

Teleophthalmology programs can be used to address screening burdens in developing nations.²³

TELEOPHTHALMOLOGY: CREATING OPPORTUNITY

Teleophthalmology is an effective tool to overcome geographic, educational, and financial challenges. It can improve access for at-risk populations by providing direct access to ophthalmologic care from a distance. It is our hope that technology for teleophthalmology will become more fully integrated into primary care and other distributed locations to further improve access for patients with eye diseases. We look forward to a day when preventable vision loss can be eliminated. ■

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