

Optometry-facilitated teleophthalmology: an audit of the first year in Western Australia

Clin Exp Optom 2018

DOI:10.1111/cxo.12658

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Background: Lions Outback Vision has run a state-wide teleophthalmology service since 2011. In September 2015 the Australian federal government introduced a Medicare reimbursement for optometry-facilitated teleophthalmology consultations under specific circumstances. This audit demonstrates the first 12 months experience with this scheme. We aim to provide practical insights for others looking to embed a telemedicine program as part of delivering outreach clinical services.

Methods: A 12-month retrospective audit was performed between September 2015 and August 2016, inclusive. A research officer used a specifically designed data extraction tool to record information from all teleophthalmology consultations performed in the time period. The primary outcome was the diagnosis at the end of the teleophthalmology consultation. Secondary outcome measures included the number of teleconsultations, cataract surgery rate, remoteness area of patients referred and imaging accompanying the referral.

Results: In the 12-month period, 709 patients were referred resulting in 683 teleophthalmology teleconsultations. Cataract was the most frequent diagnosis ($n = 287$, 42.7 per cent), followed by glaucoma ($n = 77$, 11 per cent), age-related macular degeneration ($n = 30$, 4.4 per cent) and diabetic retinopathy ($n = 26$, 3.8 per cent). Of those who had teleconsultations, 98.6 per cent were from Outer Regional, Remote or Very Remote Australia. One or more accompanying images or investigations were part of 349 (49 per cent) teleconsultations, most commonly optical coherence tomography (215, 30 per cent) and fundus photography (148, 21 per cent). Face-to-face consultations were undertaken at an outreach clinic in 23 (3.4 per cent) cases, to determine the diagnosis. There were no statistically significant factors associated with attendance at teleophthalmology consultation, or for successfully undergoing cataract surgery.

Conclusion: Teleophthalmology is a valuable adjunct to regional outreach ophthalmology services, providing patients with increased access to specialist care for a wide range of ophthalmic conditions, and more efficient access to surgical care.

Submitted: 22 December 2016

Revised: 17 December 2017

Accepted for publication: 18 December 2017

Key words: ophthalmology, optometry, telehealth, telemedicine, teleophthalmology

Over the last decade the field of telemedicine has developed from an interesting research modality¹ to an established and evidence-based mode of service delivery.² Telemedicine has been defined as the use of a range of technologies to provide medical care over a geographical distance.³ Telemedicine can be broadly grouped into two categories: store-and-forward and real-time. Store-and-forward telemedicine refers to the process of collecting information to be reviewed at another time by a specialist. However, real-time telemedicine requires face-to-face interaction between the provider and patient via a videoconferencing platform.

Ophthalmology has been at the forefront of telemedicine research, in part due to the already established use of imaging and the lack of access to specialist ophthalmology services in regional areas.⁴ Teleophthalmology is a widely accepted term for the use of telemedicine to provide ophthalmology teleconsultations.⁵ Research to date has explored the use of teleophthalmology in screening for diabetic retinopathy⁶ and glaucoma,⁷ shared care models of care for glaucoma,⁸ in the emergency department,⁹ in rural outreach clinics,^{1,10,11} and for the assessment of retinopathy of prematurity.¹²

Lions Outback Vision, based in Perth, Western Australia, has been running a

teleophthalmology service as an adjunct to its co-ordinated ophthalmology and optometry outreach services since 2011.¹¹ The program combines store-and-forward and real-time teleophthalmology modalities. A typical teleconsultation involves an initial examination by the optometrist who takes a history and organises relevant scans and images. This information is forwarded to the ophthalmologist who then participates in a real-time teleconsultation with the patient and local optometrist via video conference, either immediately if available, or otherwise at a later scheduled time.

In 2014 Lions Outback Vision demonstrated that providing a teleconsultation

reimbursement to optometrists for providing a teleophthalmology consultation led to significantly more teleophthalmology consultations being performed.¹³ This research evidence was used to successfully lobby the Australian government to provide funding for a reimbursement through the public health system, Medicare. In September 2015 a Medicare Benefit Schedule reimbursement for optometrists was introduced to facilitate teleophthalmology consultations. The reimbursement was made available to optometrists to provide real-time teleophthalmology consultations with ophthalmologists for patients that are at least 15 km by road from the ophthalmologist providing the service, are based at an Aboriginal Medical Service, or are in care at an aged care facility.

The aim of this audit is to assess the first year of Medicare-funded teleophthalmology consultations performed by Lions Outback Vision, and to provide insight into our program for other groups looking to embed a telemedicine service as part of a regional outreach model of care.

Methods

Ethics

This study was granted exemption from formal ethics approval by The University of Western Australia Human Research Ethics Committee on the basis that it was a review of routinely collected clinical data.

Study design

This study is a retrospective audit of all teleophthalmology consultations performed by Lions Outback Vision Teleophthalmology

Service during the 12-month period from September 2015 to August 2016 inclusive.

Appointments were made by community optometrists via a secure booking form on the Lions Outback Vision website. The patient was then assigned into the next available appointment slot, or if the matter was urgent a teleconsultation was conducted as soon as the ophthalmologist was available. Once the teleconsultation was completed, a research officer reviewed the teleconsultation note and recorded a standard set of information using a custom-designed data collection tool. If there was uncertainty about the information, it was resolved by discussion with the ophthalmologist who performed the teleconsultation. If a teleconsultation was booked, but not completed (for example as the patient cancelled the appointment) this was recorded as a 'did not attend' for the purposes of data analysis.

Infrastructure

The Lions Outback Vision Teleophthalmology Service does not have a minimum infrastructure requirement for referring optometrists. Referrals are received from practices with only a slitlamp as well as practices capable of performing optical coherence tomography, visual fields, and wide angle retinal photography. Referrals are sent via a secure messaging system on the Lions Outback Vision website, known as 'Oculo' (Centre for Eye Research, Melbourne, Australia), or via fax or email.

Video conferencing is performed using freely available software such as Skype (Microsoft), and FaceTime (Apple). Practitioners are prompted to ensure that these platforms satisfy privacy requirements in their area of practice prior to using them.

Lions Outback Vision ophthalmologists conduct consultations using their internet-connected laptop or smart phone. While some consultations are conducted from the main clinic site in Perth, Western Australia, many are done from regional areas at the end of an outreach clinic or surgery day.

A part-time administrative assistant is employed by Lions Outback Vision to coordinate the booking of teleconsultations, and to follow up on outcomes such as surgery bookings following a teleconsultation.

Outcome measures

The primary outcome measure was the diagnosis at the conclusion of the teleophthalmology consultation. Secondary outcome measures included number of teleconsultations, cataract surgery rate, remoteness area of patient, and imaging accompanying referral.

Standard demographic details were collected about each patient including age, gender, Aboriginal and Torres Strait Islander (ATSI) status and postcode of normal residential address.

Data collection and analysis

Data collection was performed using a custom-designed data collection template in Microsoft Excel.

Patient postcodes were classified according to the Australian Bureau of Statistics Australian Standard Geographical Classification, Remoteness Area.¹⁴

Data analysis was performed in Stata (StataCorp, College Station, Texas, USA). Descriptive analysis was performed on the collected outcome measures. The chi-squared test and univariate logistic regression was used to test for association between categorical outcome variables and explanatory variables. A priori level of significance was determined to be less than 0.05.

Results

Over the 12-month period there were 709 patients referred to the Lions Outback Vision Teleophthalmology Service. Of these referrals, 323 (45 per cent) were female and 386 (55 per cent) were male. The median age at time of teleophthalmology consultation was 66.5 years (range 4–97 years), and 49 people (6.9 per cent) identified as being ATSI. Figure 1 shows the remoteness area distribution of patients who were referred for teleophthalmology consultation,

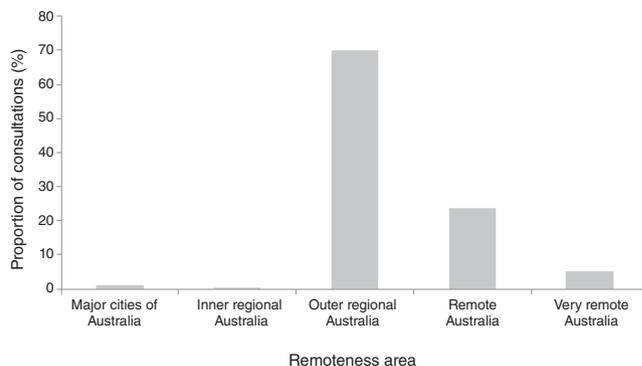


Figure 1. Remoteness area of patients referred for teleophthalmology consultation

demonstrating that 98.6 per cent of patients were from Outer Regional, Remote, or Very Remote Australia.

A total of 683 teleconsultations were conducted due to 26 (3.6 per cent) non-attendances. Age ($p = 0.11$), Remoteness Area ($p = 0.21$) and gender ($p = 0.627$) were not significantly associated with non-attendance. Of all teleconsultations, 581 (85.1 per cent) were initial consultations and 102 (14.9 per cent) were review consultations.

The most frequent diagnosis was cataract ($n = 287$, 42.7 per cent), followed by glaucoma ($n = 77$, 11 per cent), age-related macular degeneration ($n = 30$, 4.4 per cent) and diabetic retinopathy ($n = 26$, 3.8 per cent). Table 1 shows the breadth of other diagnoses made at the conclusion of the teleophthalmology consultation.

Of the 287 people diagnosed with cataracts, 254 (88.5 per cent) had visually significant cataracts requiring surgery and were booked for their surgery directly following the teleconsultation. Of these 254 people requiring cataract surgery, 232 (91 per cent) went on to have surgery. Age ($p = 0.55$) and gender ($p = 0.15$) were not statistically related to whether a patient proceeded to surgery.

Of all teleconsultation referrals, 349 (49 per cent) had one or more of the following images or investigations: optical coherence tomography (215, 30 per cent), fundus photography (148, 21 per cent), visual fields (73, 10 per cent) and slitlamp photography (43, six per cent).

Of the patients who underwent a teleconsultation, 23 (3.4 per cent) needed to be seen face-to-face at an outreach clinic to determine the diagnosis.

Discussion

This study represents the first comprehensive overview of an optometry-facilitated state-wide teleophthalmology service since the implementation of the Medicare reimbursement for optometrists to participate in teleophthalmology teleconsultations.

Over the one year study period, Medical Benefits Scheme data shows that Western Australia accounted for 81 per cent of the total national Medicare reimbursed optometrist-referred teleophthalmology consultations. This is likely due to the long-standing coordinated partnership between Lions Outback Vision and regional optometrists in providing outreach eye services, and the prior research

Diagnostic category	Diagnosis	Number	
External eye and adnexa	Allergic reaction	2	
	Blepharospasm	1	
	Dermatochalasis	5	
	Dry eye	6	
	Ectropion	2	
	Entropion	1	
	Epiphora	1	
	Lid lesion	2	
	Nasolacrimal duct obstruction	1	
	Preseptal cellulitis	1	
	Ptosis	2	
	Thyroid eye dysfunction	3	
	Trauma	6	
	Conjunctiva	Conjunctivitis	7
		Episcleritis	2
Naevus		1	
Pingueculum		1	
Sub-conjunctival haemorrhage		1	
Cornea and sclera	Adenovirus	2	
	Corneal abrasion	2	
	Epitheliopathy	1	
	Keratitis	20	
	Keratoconus	1	
	Pterygium	27	
	Scar	4	
	Scleritis	1	
Anterior chamber and uveal tract	Narrow angles	2	
	Pigment dispersion syndrome	1	
	Uveitis	20	
Lens	Posterior capsular opacification	18	
	Post cataract surgery review	32	
Vitreous and retina	Central serous chorioretinopathy	6	
	Choroid naevus	1	
	Cystoid macular oedema (non-diabetic)	3	
	Epiretinal membrane or vitreo-macular traction	11	
	Krill's disease	1	
	Macroaneurysm	1	
	Macular dystrophy	1	
	Macular haemorrhage	1	
	Macular hole	3	
	Posterior vitreous detachment	6	
	Retinal artery occlusion	1	
Retinal detachment/tear	7		
Retinal hole	1		
Retinal scarring	1		
Retinal vein occlusion	6		
Vitreous haemorrhage	2		
Vitreo-macular traction	1		

Table 1. Diagnoses classified as 'other'

Diagnostic category	Diagnosis	Number
Optic nerve head	Ocular hypertension	3
	Optic nerve head drusen	2
	Optic neuropathy	6
Other	Contact lens intolerance	1
	Neurological	5
	No abnormality detected	3
	Refractive error	7
	Undifferentiated	25

Table 1. Continued

investigating the impact of introducing a Medicare reimbursement conducted in 2014.

The diverse pathology managed suggests that teleophthalmology can be used to provide specialist input into a broad range of general ophthalmic conditions. The remoteness areas of the patients seen indicates the utility of telehealth in addressing the disparity between regional and metropolitan areas in the access to specialist eye care.¹⁵ While teleophthalmology was successful in establishing a diagnosis 95 per cent of the time, it is important that appropriate referral pathways are established for instances where the diagnosis is uncertain. In our practice, if the diagnosis is uncertain, a patient is booked into the next outreach ophthalmology clinic visit, or if more urgent, transferred to Perth for assessment.

A goal of outreach ophthalmology services is to provide efficient access to surgical intervention where it is required. This study highlights the efficiencies in using teleophthalmology to book patients directly for surgery. Over the study period 287 patients with cataracts were seen and managed by teleophthalmology. This had two main benefits: it saved the equivalent of over 10 outreach ophthalmology clinic days of consultations (based on outreach clinic day average number of patients being 25) allowing this time to be used for other patient assessments with more complex pathology. In addition, it allowed patients requiring cataract surgery to be booked directly and avoid the 'hidden waiting list' for a specialist outpatient appointment prior to being booked for surgery.

As a retrospective audit, this study lacked the methodological rigour of a comparator to determine the cause-effect relationship between the service and some of the perceived benefits. While there is a benefit in

timely access to treatment using teleophthalmology to book patients directly to surgery, the study did not allow this benefit to be qualified. Our group is currently conducting further research to quantify this benefit.

Further, this study has not investigated the costs and change management processes involved in starting a teleophthalmology service as an adjunct to visiting outreach services. Groups interested in starting a teleophthalmology service are invited to contact the authors to discuss these matters in more detail.

This study included the sparse regional population of Western Australia distributed over great geographical distances. Practitioners interested in implementing a teleophthalmology service should evaluate how their population compares and tailor these findings to their context.

There was also a degree of heterogeneity in optometrist assessment between different sites due to skill sets and the availability of equipment. Previous studies have identified that optometrist referrals can lack clinically important information up to 34 per cent of the time¹⁶ and that education and reminders of important information may help to increase the accuracy of referrals.¹⁷ The development of resources, such as the guidelines of the Royal Australian and New Zealand College of Ophthalmologists for shared care management with optometry will assist in decreasing the heterogeneity and ensuring patients receive a high standard of care.¹⁸

Conclusion

This study provided the first assessment of optometric-facilitated teleophthalmology consultations since the introduction of the

Medicare-funded reimbursement in September 2015. Teleophthalmology is a valuable adjunct to regional outreach ophthalmology services, providing patients with increased access to specialist care for a wide range of ocular conditions, and more efficient access to surgical care.

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