

Overview of diabetic retinopathy screening

Diabetes and its chronic complications disproportionately affect populations in low to middle income countries and Indigenous peoples, including Indigenous Australians¹. As diabetic retinopathy is often asymptomatic and the related vision loss is largely avoidable, retinopathy screening is an essential risk management strategy. Ophthalmologists and optometrists remain at the forefront of retinopathy screening and have increased provision of outreach services and use of innovative telehealth and mobile technologies². However, as the number of people with diabetes is growing, the global ophthalmic workforce is too small and unevenly distributed, being concentrated in urban regions of developed countries, to remain the sole frontline provider of retinopathy screening³.

Diabetic retinopathy screening guidelines

Complementary diabetic retinopathy screening approaches have emerged, such as population-specific guidelines and programmes led by non-ophthalmic clinical staff. This strategy is supported in Australia's National Health and Medical Research Council Guidelines for the Management of Diabetic Retinopathy (2008), which recommends biannual screening for non-Indigenous Australians, annual screening for Indigenous Australians and camera-based primary care screening where barriers exist to regular comprehensive eye examinations.

To improve retinopathy screening coverage in under-resourced settings, the International Council of Ophthalmology recently updated Guidelines for Diabetic Eye Care to include screening protocols specifically for under-resourced settings⁴. They recognised the substantial differences between high, intermediate and low-resourced countries of: healthcare

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infrastructure, funding, policies, public health awareness of retinopathy, surgical facilities and the ophthalmic workforce of primarily ophthalmologists and optometrists. This prompted global action for the development of retinopathy screening and management recommendations applicable to local resources. Recommendations now include less-demanding options for diabetic retinopathy screening in under-resourced settings to be delivered by non-ophthalmic clinicians, such as nurses, general practitioners, endocrinologists and healthcare workers.

Screening coverage and related vision outcomes

In Australia, the retinopathy screening workforce is largely an urban ophthalmic workforce. Despite this, the first population-based National Eye Health Survey, conducted across 30 randomly selected sites within Australia, reported in 2016 that national diabetic retinopathy screening coverage among non-Indigenous Australians had increased from 50% to 78%⁵. This is above the 75% ‘acceptable coverage’ benchmark used in the mature UK national Diabetic Eye Screening programme⁶. Among Indigenous Australians, retinopathy screening coverage from a previous study (2008) increased from 20% to 53% in 2016⁷, due largely to an increase in (effective but costly) optometry and ophthalmology outreach services in regional and remote Australia. However, this improved coverage still falls well-short of ‘acceptable coverage’ of 75% and demonstrates an ongoing screening gap between Indigenous and non-Indigenous Australians that needs to be addressed. Consistent with this, Indigenous blindness and impaired vision rates are unacceptably high in Australia, with relative risk of vision loss and blindness in Indigenous adults compared with the wider Australian adult population being 2.8 and 6.2, respectively⁸.

Australian camera-based retinopathy screening initiatives

For over 20 years, local diabetic retinopathy screening programmes and pilot studies have been undertaken in Australian community, primary care and specialty settings, such as the Western Australian Kimberly Diabetic Retinopathy Screening initiative, implemented across 17 remote Indigenous primary care settings. Over 10 years (1996–2006) this initiative increased screening rates three-fold⁹. Many studies have proven efficacy of diabetic retinopathy screening in research settings, such as: an orthoptist-based opportunistic screening initiative trialling automated real-time grading of retinal fundus images from patients with type 1 diabetes attending a city hospital endocrinology outpatient clinic¹⁰, a nurse-led screening initiative within a pathology service with grading in an offsite grading centre; a screening initiative in the Northern Territory led by Aboriginal Health Workers and Practitioners with grading in a remote city-based retinopathy grading centre¹¹; and a mobile outreach screening service in rural and remote communities¹². To date, these models of diabetic retinopathy screening implementation in Australia have demonstrated efficacy, but have had varying degrees of success beyond the research setting, partly due to inadequate public awareness of diabetic retinopathy, high retinopathy screening program costs and inadequate screening integration into existing clinical workflows.

Building capacity through national funding and training initiatives

To support the uptake of diabetic retinopathy screening by non-ophthalmic clinicians, the Australian government introduced a new Medicare initiative in November 2016. The Medicare item numbers 12325 and 12326 provide a rebate to GPs and endocrinologists for appropriate use of retinal fundus cameras for diabetic retinopathy screening, based on either

non-mydriatic and/or mydriatic retinal imaging, as appropriate. Pupils require dilation if pupil diameter is <3 mm or undilated images are ungradable, as only retinopathy reports based on gradable images are funded by Medicare. This financial aspect will **support rollout and sustainability of robust camera-based diabetic retinopathy screening services**. Non-Indigenous Australians are eligible bi-annually, while Indigenous Australians are eligible annually, for Medicare-funded, non-ophthalmic, camera-based retinopathy screening in primary care or diabetes clinics. In addition, the Australian government has invested millions of dollars in infrastructure and training of primary care staff to roll out retinopathy screening programmes across rural and remote Indigenous primary care health services. Specifically, participating Indigenous primary care health services are provided with a digital non-mydriatic camera, a short onsite training course on camera use and an online retinopathy grading course for GPs. This programme is led by a consortium, including: the Brien Holden Vision Institute, the Australian College of Optometry, Optometry Australia, the Australian Health Council of South Australia and the Centre for Eye Health Australia. The impact of these important initiatives is yet to be evaluated.

Building screening capacity through service integration

To optimise the clinical benefits of these key initiatives, novel models of integrating diabetic retinopathy screening into routine clinical workflows are needed. One successful model of diabetes care integration has been diabetes education integration into primary care and diabetes clinics through the evolution of the profession of credentialed diabetes educators. Credentialed diabetes educators teach, coach and motivate people with diabetes to meet their diabetes management goals. An important diabetes management goal is regular retinopathy

screening, which includes vision assessment. Findings from one Joslin Vision Network telehealth eye care program demonstrated that when retinal imaging was combined with diabetes education and intertwined with a patient's standard care, there were improved adherence to annual retinopathy screening and HbA1c and LDL-cholesterol levels, and patients became more motivated in their diabetes self-management¹³.

Addressing adherence with an image-based model of education and retinopathy screening

Cultural differences may contribute to the diabetic retinopathy screening gap between Indigenous and non-Indigenous Australians. Generally, Indigenous Australians are more responsive to learning through narrative and imagery than through text. Imagery and narrative are fundamental to Indigenous 'ways of learning' and are key elements of cultural pedagogy¹⁴. As such, Indigenous cultural pedagogy strongly supports the integration of retinopathy screening and diabetes education, where retinal images are used to not only assess retinopathy status but also facilitate diabetes education. Patients are able to view their retinal fundus images in real-time and also provide the diabetes educator with increased scope to engage the patient in their diabetes self-management.

A novel model of integrated diabetic retinopathy screening

Currently, credentialed diabetes educators with retinal imager training are a scarce, but potentially valuable, resource. A large body of evidence from camera-based screening studies since the 1990s demonstrates that retinal photography with digital retinal cameras is a skill readily acquired by non-ophthalmic clinical staff, including general practitioners, nurses and Aboriginal health workers^{11,12}. Endocrinologists are also potential trainees. In general, all

healthcare workers in primary care and diabetes clinics are trained in a range of screening procedures, such as survey administration, health education, and counselling, and should be able to become proficient in diabetic retinopathy screening and retinal fundus image-based education with little additional training. Given many modern retinal cameras are semi-automated, minimal training is often required for retinopathy screening image acquisition. Online grading certification is available for those interested in providing both imaging and grading services.

Quality assurance measures

Attention must also be given to pupil dilation protocols, as small pupil size is a common cause of ungradable retinal images, which are not reimbursed by Medicare and necessitate referral to an ophthalmic clinician for a dilated comprehensive eye exam. We suggest that a formal imager certification process would be a useful quality assurance step. Similarly, robust accreditation and quality control of **any** non-ophthalmic retinopathy graders is also desirable. This would provide acknowledgement of the training and practice undertaken to upskill to proficient retinal imager and / or grader status and may help engage staff in diabetic retinopathy screening. **We anticipate image grading for retinopathy and unrelated ocular findings, such as melanoma, would be largely performed externally by local ophthalmic clinicians or certified graders, such as those in the Centre for Eye Health Research, through collaborative arrangements with primary care and diabetes clinics. With robust training other incidental findings, such as toxoplasmosis scars and variants of normal such as a tigroid fundus, that often trigger concern in a non-ophthalmic clinician and an urgent referral to an ophthalmologist may be better dealt with.**

In our view, credentialed diabetes educators who are also trained as retinal imagers are well-placed to include retinopathy screening into their scope of practice and clinical service. This integrated clinical service should; augment the retinopathy screening achievements of Australia's ophthalmic professions, support the implementation and sustainability of the newly-funded Federal government retinopathy screening infrastructure and training initiatives in Indigenous primary care clinics, support uptake of the new Medicare item numbers for screening by non-ophthalmic clinicians using retinal cameras, improve screening coverage among Indigenous Australians, assist patients to achieve their diabetes management goals and, in the longer term, reduce risk of other diabetes complications.

Whether this novel model of integration of diabetic retinopathy screening and diabetes education into a single clinical service will improve health service retinopathy screening coverage, patient self-management, vascular risk factor control and vision outcomes and is unknown, but worthy of investigation.

In summary, current clinical challenges are the diabetes epidemic, the ongoing gap in retinopathy screening rates and vision outcomes between Indigenous and non-Indigenous Australians, and the small ophthalmic workforce outside major cities. Potential solutions to these challenges include screening by non-ophthalmic clinicians using digital retinal cameras, the recently implemented Medicare rebate for gradable retinal photos, off-site graders (until evolving artificial intelligence for retinal grading is available) and a model of care in which retinal imaging is undertaken by diabetes educators.

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Abstract:

As diabetes occurs in all ethnicities and regions it is essential that retinopathy screening be widely available. Screening rates are lower in Indigenous than in non-indigenous Australians. Technological advances and Medicare rebates should facilitate improved outcomes. Use of non-ophthalmic clinicians, (general practitioners, diabetes educators, health-workers and endocrinologists) to supplement coverage by ophthalmologists and optometrists would extend retinopathy screening capacity. Diabetes educators are an integral part of diabetes management. Integrating ocular screening and diabetes education in primary care settings has potential to synergistically improve retinopathy screening coverage, patient self-management, risk factor control, care satisfaction, health economics and sustainability of under-resourced services.

Key words: diabetic retinopathy, diabetic retinopathy screening, diabetes education, Indigenous Australians, credentialed diabetes educators

Integrating diabetic retinopathy screening within diabetes education services in Australia's diabetes and Indigenous primary care clinics.

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The purpose of this paper is to highlight a gap in diabetes management and suggest a potential solution: Screening for diabetic eye disease is an important diabetes risk management strategy, but screening coverage and related vision outcomes are suboptimal, particularly among Indigenous Australians, due to the nature, size and distribution of Australia's (primarily optometrist and ophthalmologist) screening workforce.