
1181

Protocol to guide the
assessment of Retinal
Photography with a
Non-Mydriatic Retinal
Camera (RP-NMRC)
in people with
diagnosed diabetes

October 2013

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Questions for public consultation

Specific questions on which PASC sought public consultation feedback are highlighted in blue throughout the document. These questions are:

- 1) *PASC seek feedback on whether it is appropriate for the reader of RP-NMRC to always be an optometrist or medical practitioner, or may certified readers, without medical qualifications, be trained to a sufficient standard to interpret the photographs? Under standard MBS rules, readers who are not medical specialists or optometrists would not be able to claim MBS items, so special rulings would need to be made, similar to specific MBS items being available to eligible nurse practitioners. (page 14)*
- 2) *What would constitute appropriate training, accreditation and quality assurance for (a) photographers; and (b) readers in the context of the proposed primary care RP-NMRC service? (page 19)*
- 3) *PASC have indicated that changes to management due to increased detection of DR are of most importance and interest for the assessment. However, prior to finalising outcomes, PASC will consider public comment on whether or not non – DR events should be included. If non-DR events are included, what is the rate of non-DR findings which are referred on? (page 25)*
- 4) *How does RP-NHMRC currently work in optometrist practice? Is it a referred service from a medical practitioner? How are patients referred if DR (or any other condition) is detected for further treatment?*

MSAC and PASC

The Medical Services Advisory Committee (MSAC) is an independent expert committee appointed by the Australian Government Health Minister to strengthen the role of evidence in health financing decisions in Australia. MSAC advises the Commonwealth Minister for Health and Ageing on the evidence relating to the safety, effectiveness, and cost-effectiveness of new and existing medical technologies and procedures and under what circumstances public funding should be supported.

The Protocol Advisory Sub-Committee (PASC) is a standing sub-committee of MSAC. Its primary objective is the determination of protocols to guide clinical and economic assessments of medical interventions proposed for public funding.

Purpose of this document

This document is a protocol that is intended to determine the likely use in Australia of retinal photography with a non-mydratiac retinal camera (RP-NMRC). The protocol will be finalised after inviting relevant stakeholders to provide input. The final protocol will be used to guide the assessment of the intervention.

The protocol has been developed using the widely accepted "PICO" approach. The PICO approach involves a clear articulation of the following aspects of the research question that the assessment is intended to answer:

Patients – specification of the characteristics of the patients in whom the intervention is to be considered for use;

Intervention – specification of the proposed intervention;

Comparator – specification of the therapy most likely to be replaced, or added to, by the proposed intervention; and

Outcomes – specification of the health outcomes and the healthcare resources likely to be affected by the introduction of the proposed intervention.

Purpose of application

An application requesting Medicare Benefits Schedule (MBS) listing of retinal photography with a non-mydratic retinal camera (RP-NMRC), for the identification of retinopathy in people with diabetes, was received from the Centre for Eye Research Australia by the Department of Health and Ageing in December 2012. The application requests an additional new item for RP-NMRC, which would be used in patients with diabetes. It also proposes a change to the descriptors of the current MBS item numbers 11215 and 11218 (11215: RETINAL PHOTOGRAPHY, multiple exposures of 1 eye with intravenous dye injection, and 11218: RETINAL PHOTOGRAPHY, multiple exposures of both eyes with intravenous dye injection). These items are usually referred to as fluorescein angiography.

An independent assessment group, as part of its contract with the Department of Health and Ageing, has drafted this decision analytic protocol to guide the assessment of the safety, effectiveness and cost-effectiveness of RP-NMRC in people with diabetes in order to inform MSAC's decision-making regarding public funding of the intervention.

Table 1: Current MBS item descriptors for 11215 and 11218

| Category 2 – DIAGNOSTIC PROCEDURES AND INVESTIGATIONS |
|---|
| MBS 11215 RETINAL PHOTOGRAPHY, multiple exposures of 1 eye with intravenous dye injection Fee: \$123.00 Benefit: 75% = \$92.25 85% = \$104.55 |
| MBS 11218 RETINAL PHOTOGRAPHY, multiple exposures of both eyes with intravenous dye injection Fee: \$151.95 Benefit: 75% = \$114.00 85% = \$129.20 |

Background

Current arrangements for public reimbursement

Retinal photography with a non-mydratic retinal camera (RP-NMRC) does not currently receive public reimbursement as a stand-alone service. The service is usually provided by an ophthalmologist or optometrist, concurrent to a comprehensive eye examination (CEE), with the additional costs of photography being an out-of-pocket expense to the patient. The existing MBS items for "retinal photography" are considered to be synonymous with fluorescein angiography, an imaging method used specifically to

assess severe retinopathy in order to guide to treatment.¹ The current item descriptors associated with this service are shown in Table 1 and the changes to these item descriptors, as proposed by the applicant, are shown in Table 2.

Table 2: Proposed changes to MBS item descriptors for 11215 and 11218

| Category 2 – DIAGNOSTIC PROCEDURES AND INVESTIGATIONS |
|---|
| MBS 11215 RETINAL ANGIOGRAPHY, multiple exposures of 1 eye with intravenous dye injection Fee: \$123.00 Benefit: 75% = \$92.25 85% = \$104.55 |
| MBS 11218 RETINAL ANGIOGRAPHY, multiple exposures of both eyes with intravenous dye injection Fee: \$151.95 Benefit: 75% = \$114.00 85% = \$129.20 |

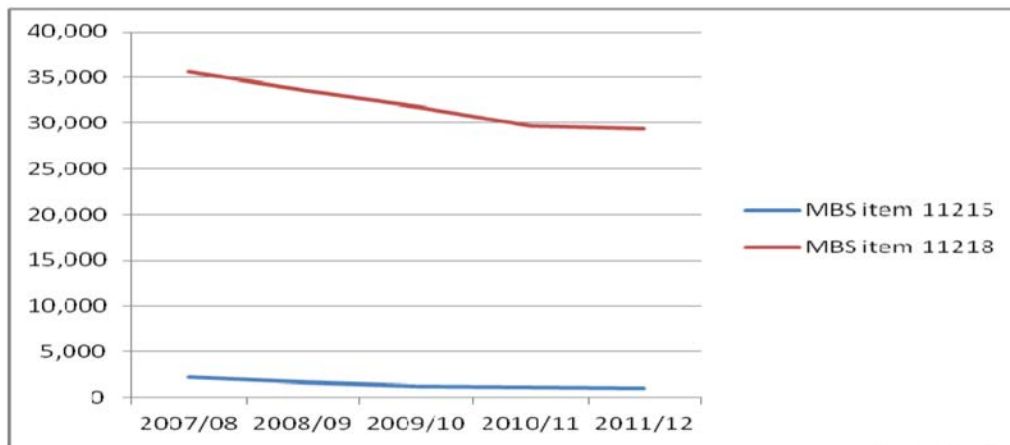
Table 3: Claims made on MBS items for 11215 and 11218 between 2007/08 and 2011/12

| Financial year | MBS item 11215 | MBS item 11218 | Total |
|----------------|----------------|----------------|----------------|
| 2007/08 | 2,214 | 35,626 | 37,840 |
| 2008/09 | 1,716 | 33,620 | 35,336 |
| 2009/10 | 1,282 | 31,810 | 33,092 |
| 2010/11 | 1,134 | 29,658 | 30,792 |
| 2011/12 | 1,061 | 29,310 | 30,371 |
| Total | 7,407 | 160,024 | 167,431 |

MBS service usage data indicate that claims for item 11218 are much more frequent than for item 11215, but that claims for both services have been steadily decreasing in the period spanning the last five financial years. These data are shown in Table 3 and represented graphically in Figure 1.

¹ HESP (ophthalmologist) advice by personal correspondence, 5th April 2013.

Figure 1: Claims made on MBS items 11215 and 11218 between 2007/08 and 2011/12



Regulatory status

Numerous non-mydriatic retinal cameras have been registered with the Therapeutic Goods Administration on the Australian Register of Therapeutic Goods (see Table 4). These devices are not exempt from the regulatory requirements of the Therapeutic Goods Act 1989.

Table 4: Devices listed on the Australian Register of Therapeutic Goods

| ARTG Identifier | Manufacturer ^b | Intended purpose |
|-----------------|-------------------------------|---|
| 107405 | Designs for Vision | For taking an image of the fundus ^b of the eye |
| 108114 | Canon Australia | Photographing eye |
| 119011 | BOC Ophthalmic instruments | To study and record images of the fundus |
| 129300 | Carl Zeiss | Fundus imaging in non-mydratic and mydratic mode |
| 131015 | Device Technologies Australia | A camera designed to photograph/record images of the ocular fundus |
| 133323 | Scan Optics | Digital fundus imaging system intended for use by optometrists and ophthalmologists. The device mounts to the tonometer adaptor of an optional slit lamp stand. The device is intended to capture an image of the patient's fundus after they are correctly positioned on the chinrest of the stand. After capture, images are intended to be downloaded from a camera to a computer. Included software enables the images to be sorted and annotated as required by the practitioner |
| 139913 | I-Optic Computing | Camera for observation of eye interior. Non-contact, non-invasive |
| 140423 | BOC Ophthalmic Instruments | To take digital photographs of the retina for optical and medical analysis |
| 141228 | Design for Vision | For taking an image of the fundus of the eye |
| 142066 | Design for Vision | Wide-field paediatric retinal imaging |
| 144145 | Canon Australia | For use to photograph the fundus of the eye |
| 152527 | Canon Australia | For use to photograph the fundus of the eye |
| 156438 | BOC Ophthalmic Instruments | To take digital photographs of the fundus to study potential eye disorders and store images for further comparisons and reference |
| 161816 | Canon Australia | For use to photograph the back of the eye |
| 164706 | Canon Australia | Observe image and record retinal fundus through the pupil without contact with subject's eye |
| 94352 | Carl Zeiss | Fundus imaging |
| 98728 | Canon Australia | Photograph the human retina |

^aOther manufacturers of fundus imaging devices include Optos and Ellex.

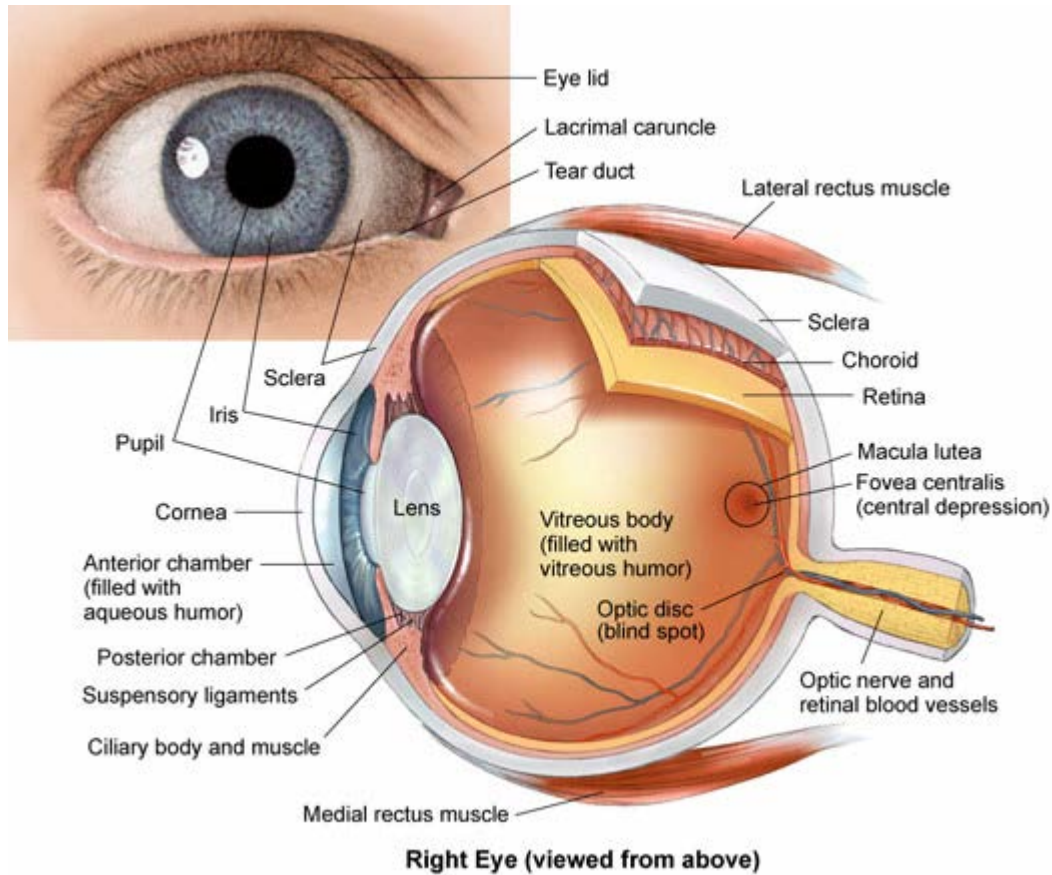
^bThe interior posterior surface of the eyeball. It includes the retina, optic disc, macula, and posterior pole (Cassin & Rubin 2011).

Intervention

Diabetic retinopathy

Figure 2 provides an overview of the anatomy of the normal human eye.

Figure 2: Anatomy of normal human eye (Biographix 2006).



Diabetic retinopathy (DR), the most common complication of diabetes, is a chronic, sight-threatening eye disease that occurs in 25 to 44 per cent of people with diabetes at any point in time. Ninety per cent of people with diabetes will have retinopathy after 25 years (NHMRC 2008)². DR is directly related to poor control of blood glucose, blood pressure and blood lipids (Schiffelers et al. 2007). Without intervention, DR progresses predictably from minimal to more severe changes, beginning with thickening of the basement membrane which lines retinal blood vessels. This thickening stops the flow of essential chemicals into and out of the retina. As a consequence, fluid leaks out of the

² The AusDiab study (n=11,247) reported, more conservatively, that 22% of people with type 2 diabetes had DR and 6% of newly diagnosed people with diabetes had DR (Tapp et al. 2003). Data from a Diabetes Centre at a major teaching hospital indicates that 18% of almost 1,000 visually asymptomatic diabetes patients have some form of DR (HESP [optometrist] advice, personal communication, received 2nd April 2013).

capillaries causing swelling of the macula³ and blurred vision. This is referred to as macular oedema, which is the most common cause of vision loss in people with diabetes, and may result in central but not peripheral vision loss. Macular ischemia occurs when the small blood vessels become so damaged that they become obstructed, depriving the macula of sufficient nutrients. The early stages of DR are referred to as non-proliferative or background diabetic retinopathy (NPDR), which is characterised by retinal vascular microaneurysms⁴, blot haemorrhages and “cotton wool” spots. As the disease progresses, damaged cells release vascular endothelial growth factor (VEGF)⁵ which then stimulates neovascularisation. The new blood vessels grow on the surface of the retina or optic nerve in order to supply the retina with sufficient nutrients. However, this vasculature is extremely delicate and prone to leakage and rupture, which may in turn cause vitreous haemorrhage⁶, scarring of the retina, or retinal detachment. This condition is described as proliferative diabetic retinopathy (PDR). It is characterised by intra-retinal microvascular abnormalities, an increased number of microaneurysms and haemorrhages, and may cause severe loss of both central and peripheral vision (AAO 2008; Curtis, Gardiner & Stitt 2009; NHMRC 2008).

The risk of DR is reduced by control of blood glucose and pharmacological treatment of hypertension (Schiffelers et al. 2007). Once DR has developed, treatment options include laser photocoagulation therapy or intravitreal anti-VEGF combined with continued control of the patient's diabetes. These treatments cannot improve vision but will prevent further damage to the macula and complications from neovascularisation. Photocoagulation has been demonstrated to lead to substantial (>50%) reduction in further vision loss (Neubauer & Ulbig 2007), however recent evidence from randomised controlled trials suggests that the use of an anti-VEGF (e.g. ranibizumab, bevacizumab) is more effective in treating the complications of DR compared to photocoagulation therapy (Mitchell et al. 2011; Thomas et al. 2013).

Description of the intervention

Regular screening to detect DR is considered essential (NHMRC 2008) as this enables timely treatment in order to minimise the degree of permanent vision loss. The current Australian NHMRC guidelines for the management of DR emphasise the importance of regular clinical assessments in asymptomatic patients at risk of developing DR. At least

³ The small area in the centre of the retina responsible for seeing fine detail clearly.

⁴ Focal dilation of retinal capillaries occurring in diabetes mellitus, retinal vein obstruction, and absolute glaucoma.

⁵ VEGF, vascular endothelial growth factor.

⁶ Haemorrhage into the vitreous humour, the transparent gel that fills the inner portion of the eyeball between the lens and the retina.

two yearly vision assessments and retinal examinations in asymptomatic patients with diagnosed diabetes are recommended because treatable retinopathy is commonly asymptomatic and timely treatment is considered key to preventing partial/complete loss of vision. Further, the NHMRC recommends that

“ophthalmologists, optometrists and other trained medical examiners should use dilated ophthalmoscopy or slit lamp biomicroscopy with a suitable lens (e.g. 78 D), to detect presence and severity of DR... with adequate sensitivity and specificity. In the absence of a dilated fundus examination by a trained examiner... non-mydratic (or mydratic) photography with adequate sensitivity, specificity and low technical failure rate [are recommended] to detect presence of DR” (NHMRC 2008).

Retinal photography with a non-mydratic retinal camera (RP-NMRC) has been proposed as a technology to detect DR in patients with diabetes thereby enabling improved management of DR.

RP-NMRC is a non-contact, non-invasive imaging technique that provides digital images of the retina and optic disc using a fundus camera. While early fundus photography utilised bright visible light, newer technologies incorporate infrared-sensitive video cameras, enabling image acquisition without the use of mydratic agents to dilate the pupil. During a typical photographic session, the viewing field⁷ is centred on the fovea (central retina) in a darkened room. The room is darkened to allow normal physiological dilation of the pupils to occur, which aids in capturing a readable image. Images are taken with the aid of a flash, which causes immediate pupil constriction. Therefore, it is usual to allow an interval of at least five minutes between imaging a patient's first and second eye, as this allows pupil recovery from the first flash. Photographs can be interpreted by an optometrist, an ophthalmologist or a specifically-trained reader, either locally or remotely, via electronic link/telemedicine. However, because RP-NMRC cannot provide a complete view of the retina, it only enables detection of DR as opposed to grading the severity of retinopathy.⁸ Accordingly, detection of DR would usually indicate referral to an optometrist or ophthalmologist for a comprehensive assessment.⁹ Non-

⁷ Typically a fundus camera will cover 45 to 60 degrees in one exposure. Special software may be used to combine multiple frames to achieve a coverage of up to 140 degrees, while ultra-wide field retinal imaging can capture up to 200 degrees in a single exposure (Soliman et al. 2012).

⁸ HESP advice (ophthalmologist, optometrist) is that a limited level of grading may be achieved, but even with an ideal photograph, subtle changes may be missed. Photographs of poorer quality may conceal diffuse and/or more severe disease.

⁹ In the opinion of one HESP member (optometrist) detection of minimal to moderate NPDR by an optometrist would not necessarily require referral to an ophthalmologist (personal correspondence, 2nd April 2013). The NHMRC guidelines on DR state that *“patients should be referred promptly for dilated fundus examination if non-mydratic photographs cannot be graded.”* In a clinical setting, the guidelines recommend grading using the International Clinical Diabetic Retinopathy and Diabetic Macula Edema Disease Severity scales which

mydriatic cameras are portable and easily transported to rural or remote settings for use by non-medical staff who have been accredited via appropriate technical training (Heaven, Cansfield & Shaw 1993; NHMRC 2008; Williams et al. 2004).

The applicant claims that RP-NMRC provides a means of documenting detailed information on the retina, and can therefore detect early clinical changes before visual symptoms occur. It is claimed that RP-NMRC will provide an impetus and means for earlier detection of DR and vision loss and promote regular eye examinations in those who do not currently access regular eye exams. Any Medicare service provider who routinely provides healthcare services to people with diabetes could order or perform RP-NMRC (see "Proposed MBS listing"), or could use accredited imagers to perform RP-NMRC under their supervision. Analysis, interpretation and diagnosis from the images can be completed within 10 minutes, including preparation of the report. Typically the whole process takes less than 15 minutes. Medicare service providers would be responsible for determining the level of presenting vision in each eye and would report on the quality of the images, the degree of DR (possible only with images of good quality), and the necessity of referral for further ophthalmic assessment (mandatory when images cannot be graded; see NHMRC guidelines). RP-NMRC is believed to be a safe, fast and convenient way of detecting retinal changes (Aung et al. 2009; Baeza et al. 2009; Hansen et al. 2004; Lopez-Bastida, Cabrera-Lopez & Serrano-Aguilar 2007).

There are many clinicians in Australia, mostly optometrists, who independently screen for DR using retinal photography, while some public hospitals and health services use RP-NMRC to screen for DR under an ophthalmologist's supervision (HESP advice; ophthalmologist). There is no specific accreditation required to provide RP-NMRC for either optometrists or ophthalmologists as it is considered a part of professional practice for these clinicians¹⁰. However, as PASC has determined that the proposed service is most appropriately placed in the primary care setting, and should not be a service claimed for subsidy by optometrists or ophthalmologists, training to enable competent service delivery by GPs and non-medical staff will need to be considered in the submission-based assessment of RP-NMRC. The applicant reports that non-mydriatic retinal cameras have been in use overseas for more than a decade in the UK, Scandinavia, USA and Singapore. Over the last 15 years, several pilot projects have used these cameras in Australia (Aung et al. 2009; Harper et al. 1998; Phiri et al. 2006). HESP (optometrist) advice is that the Optometrists Association of Australia conducted a

propose five levels for grading of DR, based on risk of progression: None, Mild, NPDR, Moderate NPDR, Severe NPDR or PDR. In the research setting, the modified Airlie House classification (Wisconsin system) has become the basis for detailed grading of DR.

¹⁰ HESP (optometrist, ophthalmologist) advice, personal correspondence received 5th April 2013.

survey of their members, with the finding that approximately 60 per cent of the membership had retinal fundus cameras¹¹.

Burden of disease

Diabetic eye disease is a common and important cause of disability in diabetes. The Australian incidence of DR is about eight per cent per annum. Prevalence of DR among people with diabetes in Australia is high, between 25 and 44 per cent, with an estimated overall prevalence of 40 per cent (NHMRC 2008).

The AIHW estimates the total number of people living with diabetes varies considerably, and is likely to under-represent the true prevalence of diabetes in the Australian population. The most recent AIHW data (2007-2008) indicate that close to 900,000 Australians have been diagnosed with diabetes, of whom 87 per cent have Type 2 diabetes, ten per cent have Type 1 and three per cent have diabetes of unknown type (AIHW 2011). Based on the current Australian population of approximately 23 million (www.abs.gov.au), the overall prevalence of Type 2 diabetes is calculated to be 3.4 per cent ($900,000/23 \text{ million} \times 100 \times 0.87$). Given the prevalence of DR among persons with diabetes (25-44%), this equates to an overall Australian prevalence of 0.9-1.5 per cent for DR. This is a conservative estimate given that many cases of diabetes are undiagnosed and therefore not represented in the available data. Applying data from the Australian Diabetes Council, which suggest 1.2 million Australians have diabetes (HESP [optometrist] advice, personal communication, received 2nd April 2013), the prevalence has been recalculated as 1.1-2.0 per cent.

One third of people with DR require referral for photocoagulation. Diabetes also increases the risk of cataracts and glaucoma in those with DR. Consequently, the risk of vision loss is 25 times higher for Australians living with diabetes than those without. The incidence and prevalence of DR will continue to increase in line with the increasing prevalence of diabetes. Indigenous Australians are at particularly high risk of diabetic retinopathy and vision loss. According to the applicant¹²:

- the prevalence of diabetes in Indigenous Australians is more than three times the rate of that in non-Indigenous Australians¹³;

¹¹ Further comment was made that digital non-mydratic photographs would have diffused widely into ophthalmic practice and in telemedicine in Australia. Telemedicine for fundus photography is/has been used in remote communities in almost all states in Australia (personal correspondence received 2nd April 2013).

¹² The diabetologist member of HESP (Health Expert Standing Panel) has expressed that these figures are correct.

¹³ The AIHW reports that the proportion of Indigenous to non-Indigenous people with diabetes is 3:1 (<http://www.aihw.gov.au/diabetes/>).

- 37 per cent of Indigenous adults over 40 years self-report as having diabetes (consistent with findings from the National Indigenous Eye Health Survey (Xie et al. 2011));
- 75 per cent of Indigenous adults with vision loss have diabetes;
- the risk of vision loss in Indigenous Australians with diabetes is eight times the risk of vision loss and blindness in those without diabetes (similar to findings among remote communities in Western Australia (Clark et al. 2010)); and
- 9 per cent of blindness in Indigenous people is caused by retinopathy.

Current practice

NHMRC guidelines (2008) recommend eye examinations every two years for non-Indigenous Australians and annual examinations for Indigenous Australians with diabetes. According to the applicant, approximately 50 per cent of non-Indigenous and 20 per cent of Indigenous Australians with diabetes comply with these guidelines (Harper et al. 1998; Taylor et al. 2009), and less than half of those who need photocoagulation have received it. More recently, it was found that 44 per cent of Indigenous Australians have not had a diabetic eye screening in the previous year (Ku et al. 2013). Eye examinations involve visual acuity testing and an ocular fundus examination, usually through dilated pupils. During this examination, a retinal photograph may be taken. If there is a reduction in visual acuity, appropriate management is determined depending on the cause, or if the patient is presenting to an optometrist or GP, referral to an ophthalmologist may be necessary for a proportion of cases.¹⁴

Diagnosis of DR is accomplished by imaging the retina of the eye through the pupil. Various instruments may be used for this purpose. Ophthalmoscopes are instruments containing an arrangement of lenses and a source of illumination that allows direct visualisation of the eye's interior. The hand-held direct ophthalmoscope is a standard type in clinical use, but studies have reported low diagnostic accuracy for this instrument (Siu et al. 1998) and hence many optometrists and ophthalmologists prefer the binocular indirect ophthalmoscope and slit lamp biomicroscope with indirect lenses. According to NHMRC guidelines, clinical examinations to assess the presence or severity of DR may use slit lamp biomicroscopy, ophthalmoscopy or retinal photography (NHMRC 2008). The biomicroscope (slit lamp) has the added advantage of a stereoscopic view which allows an appreciation of depth. Slit lamps are in wide clinical use, predominantly throughout optometric practice, however very few GP or diabetes clinics have access to slit lamps. Retinal cameras are newer technologies that consist of an optical system that

¹⁴ HESP advice (optometrist), personal communication received 5th April 2013.

is designed to focus on the ocular fundus. An image capture device such as a digital camera is mounted on top of the optical system.

Delivery of the intervention

Retinal photography with a non-mydratic camera is a procedure intended for detection of DR and would be used in accordance with current NHMRC guidelines.

The applicant has recommended that the new service is undertaken in a primary care or community setting and suggested it could be undertaken anywhere a Medicare service provider routinely performs services for patients with diabetes. PASC have advised that the service should be reserved exclusively for use in primary care settings (eg GP rooms, diabetes clinics and Indigenous health clinics). However, PASC suggested that the interpretation of the photograph and claiming of the MBS item should be restricted to optometrists and medical practitioners (GP or ophthalmologist).

Question for consultation: PASC seek feedback on whether it is appropriate for the reader of RP-NMRC to always be an optometrist or medical practitioner, or may certified readers, without medical qualifications, be trained to a sufficient standard to interpret the photographs? Under standard MBS rules, readers who are not medical specialists or optometrists would not be able to claim MBS items, so special rulings would need to be made, similar to specific MBS items being available to eligible nurse practitioners.

The applicant has proposed that patients would be eligible to receive RP-NMRC if they have medically diagnosed diabetes, and no evidence of visual impairment¹⁵. The applicant also proposed that the service should be restricted to the subset of the above population, who have not had a CEE with an ophthalmologist/optometrist within the previous two years (one year for Indigenous Australians). However, PASC advised that it is difficult for those in a primary care setting to determine through Medicare mechanisms whether patients have had a CEE with an eye specialist in the previous 2 years (or one for Indigenous), and this restriction should not be specified in the MBS item description. RP-NMRC would be used at a maximum frequency of once every two years (or annually for Indigenous Australians). It was noted that in the future, once e-health records have become established, tracking the use of MBS items across medical specialties will become easier.

PASC has advised that visual acuity testing is performed in GP, diabetes and Indigenous health clinics and that people with diabetes who are visually impaired, as defined by the

¹⁵ The applicant defined the level of vision impairment that would exclude patients from eligibility as distance vision of less than 6/12 in either eye, or a difference of more than two lines of vision between the two eyes at the time of presentation. Presenting distance vision is understood to mean either unaided distance vision or the vision obtained with the current spectacles or contact lenses, if normally worn for distance vision.

applicant¹⁶, should be referred for CEE, and should not be eligible for publicly funded RP-NMRC.

The service item will not be available for billing by optometrists and ophthalmologists, and therefore referral for further testing and management would be required in all instances where DR is detected. The “Explanatory notes” for the proposed item number (Table 6) provide specific details on referral requirements. Where the initial test result is negative for DR, PASC agreed that retesting for those that continue to have a negative result should occur at intervals as proposed by the applicant (i.e two yearly and annually for non-Indigenous and Indigenous Australians respectively), being consistent with the NHMRC guidelines on DR.

The expected usage of the proposed Medicare item number has been estimated based on:

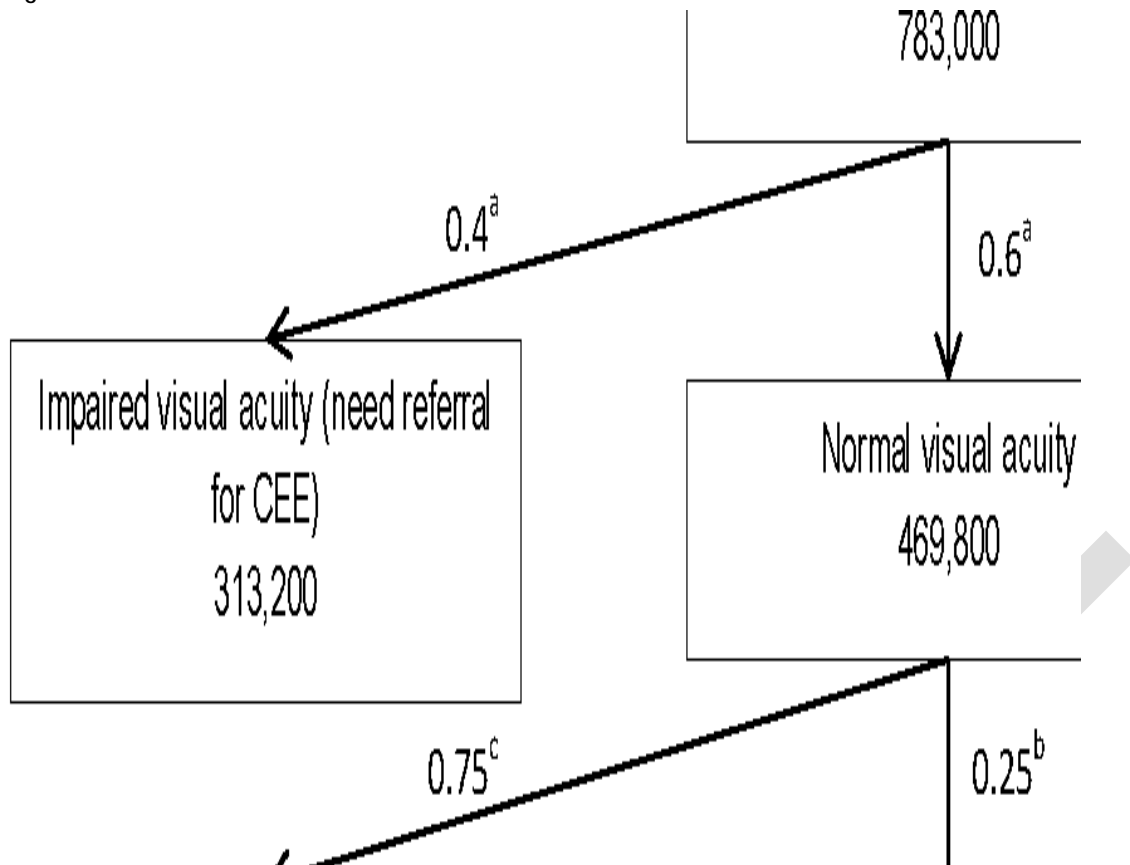
- a) the number of eligible persons with Type 2 diabetes; and
- b) who do not have visual impairment; and
- c) the estimated practitioner/patient uptake.

Figure 3 outlines the expected uptake of RP-NMRC. The AIHW estimates 783,000 Australians currently have type 2 diabetes (AIHW 2011), and of these, 40 per cent are expected to already have visual impairment (Harper et al. 198)¹⁷, leaving 469,800 who require screening for DR. It is expected that the majority of these patients would undergo CEE by an ophthalmologist or optometrist. The applicant has estimated that uptake of RP-NMRC would be up to 25 per cent of those with diabetes, free from visual impairment (i.e. 117,450 per annum), with the expense of acquiring a fundus camera being a limiter. Capital equipment costs for a fundus camera are shown in Table 5. The applicant suggests that one third of patients (38,759) receiving an examination for the first time will be found to have signs of retinopathy requiring referral for further evaluation and that this population would not need the proposed service in the future.

¹⁶ HESP endorsed this definition at the PASC meeting held on 18 April 2013.

¹⁷ This study found that of 1,177 people with diabetes screened for DR using RP-NMRC, 30 per cent had signs of visual impairment of whom only 3 per cent had no evidence of underlying pathology, and 10 per cent of patients yielded ungradable photographs. The remaining 60 per cent of persons screened had normal visual acuity.

Figure 3 Estimated use of RP-NMRC



^a Harper et al, 1998

^{b, c} Applicant estimates

Table 5: Capital equipment costs for non-mydrriatic retinal photography, effective as of July 2013

| Non-mydrriatic camera | Cost (Australian dollars) |
|------------------------------|---------------------------|
| Canon CR2 | \$26,400 |
| Canon CR2 Plus | \$30,800 |
| Canon CR2 Plus AF | \$38,500 |
| Cobra CSO-272 | \$15,990 |
| Horus hand held (MIS-901890) | \$9,500 |
| Kowa 500 | \$26,500 |
| Kowa 800 | \$25,500 |
| Kowa 900 | \$32,900 |
| Nidek AFC330 | \$28,600 |
| Topcon TRC-NW8 | \$34,450 |

Source: correspondence with multiple suppliers via HESP (optometrist) on 30 July 2013.¹⁸

¹⁸ For additional cost information see Lenferink, A (2011). Use of non-mydrriatic cameras for diabetic retinopathy screening in community based settings. CERA, Melbourne.

Prerequisites

In Australia, medical practitioners responsible for managing people with diabetes have two options for detecting DR: (a) undertake detection themselves (including by personnel under their supervision) and subsequently arrange referral if retinopathy or vision impairment is detected; or (b) refer patients in their care to an ophthalmologist or optometrist (the professions in Australia that routinely perform retinal examinations of people with diabetes).

Training and accreditation

The applicant considers that it is much easier for GPs to recognise early retinopathy on a photograph than through an ophthalmoscope as they are currently expected to do, especially through an undilated pupil. Initial training in reading of retinal photographs for these practitioners could be provided by ophthalmologist or optometrist colleagues. Other forms of training using a DVD or a dedicated webpage could also be considered.

RP-NMRC could be undertaken by personnel without formal medical qualifications, who may be employed in diabetes clinics, general practice, health centres or remote areas not regularly visited by an ophthalmologist or optometrist. Clinical expert advice indicates that fundus images need to be of good quality to be appropriately assessable, and it has been suggested that remuneration for the proposed MBS item number should only occur if adequate images are obtained.¹⁹ PASC advice is that in order to ensure the quality of fundus images for diagnostic purposes, technical staff using non-mydratric cameras would need training and evidence of competence through accreditation and a quality assurance program.

The applicant has advised that several programs are currently available for accreditation in the use of RP-NMRC including programs from the UK²⁰, US and one developed through the University of Queensland and the Royal Australian College of General Practitioners, as part of an NHMRC Partnership Grant. The Diabetic Retinopathy Grading Centre at the Centre for Eye Research Australia has also been providing this type of training for around 10 years and these programs may provide suitable templates to design an Australian-based program. Engagement with both the Royal Australian and New Zealand College of Ophthalmologists (RANZCO) and the Optometrists Association of Australia (OAA) to oversee the curriculum development, training and accreditation in each state of Australia could be another approach.

¹⁹ HESP (optometrist) advice, personal communication received 2nd April 2013. Note: A recent study found that up to 20% of NMP images were unusable (Ku et al. 2013).

²⁰ See <http://diabeticeye.screening.nhs.uk/>

From an Indigenous health perspective, it may be possible to integrate training and education within the federally funded Quality Assurance for Aboriginal and Torres Strait Islander Medical Services (QAAMS) program²¹. This program already has a strong emphasis on diabetes care and it would appear logical to develop training which can be used within the existing framework and infrastructure to further augment diabetes care for Indigenous Australians.

One member of the HESP (optometrist) advised that training in the use of RP-NMRC has been piloted in an Australian pathology service. The study reported that “two pathology collectors completed a 21-hour onsite training course in non-mydratic retinal photography, image management system operation and visual acuity assessment. Pathology personnel conducted all screening tests and were certified in retinal photography before data collection.” The authors found that gradable images were obtained in 74.2 per cent of eyes photographed (Larizza et al. 2013). HESP also advised that suppliers of the retinal cameras provide installation and initial instruction regarding the usage of the instrumentation and software. Once the initial set-up is complete, it should be possible to develop a methodology for credentialing those taking the photographs and those reading the images, and developing a system which will assist those reading the images to transmit their findings to the relevant health care practitioners.

If the Medicare service provider requesting the procedure does not perform the imaging and reading functions, additional staff may be required. However, prior to any RP-NMRC service, visual acuity should firstly have been determined in the primary care setting (i.e GP, Indigenous health or diabetes clinic). As noted above, PASC has emphasised the requirement to determine visual acuity, thereby enabling appropriate referral of visually impaired people with diabetes for CEE as this population should not be eligible for publicly funded RP-NMRC. For persons assessed as free from visual impairment, the next step would be for a trained imager to take retinal photos with a non-mydratic camera. The imager would be responsible for maintaining the camera and image quality, and a certified reader would then be required to identify DR where present and provide a report, including an appropriate referral timeframe, to the patient’s medical practitioner responsible for the diabetes care plan/management.

It would be possible to perform the RP-NMRC procedure in a range of primary settings: GP rooms, diabetes clinics, health centres etc., using an appropriate retinal camera.

²¹ <http://www.qaams.org.au/education.htm>

Question for consultation: What would constitute appropriate training, accreditation and quality assurance for (a) photographers; and (b) readers in the context of the proposed primary care RP-NMRC service?

Co-administered and associated interventions

Patients are only considered for RP-NMRC if they are diagnosed with diabetes. Given that the diagnosis must precede RP-NMRC, the demand for diagnostic tests for diabetes would remain unchanged if the proposed listing occurs.

Listing proposed and options for MSAC consideration

Proposed MBS listing

The proposed MBS listing for RP-NMRC is outlined in Table 6. Retinal photography with a NMRC is to occur in the primary care setting (i.e the photographs are expected to be taken by a GP, or technicians within Indigenous health clinics or diabetes clinics), but the interpretation of the photograph is limited to optometrists, and medical practitioners such as a GP or ophthalmologist. PASC have advised that in instances where the photographs are taken by a technician and then read by a medical practitioner (i.e the photographer and reader are not the same person), an internal arrangement will need to be made regarding division of the fee for the service provided, as only medical practitioners are able to claim MBS fees. The proposed item is expected to go into two different sections of the MBS, one to be claimed when the reader of the photograph is a medical practitioner (Category 2), and one to be claimed when the interpretation of the photograph is performed by an optometrist (Group A10).

Given the large variability in the capital costs associated with non-mydratic retinal cameras (see Table 5, page 17), justification of the proposed fee should be included in the assessment.

Table 6: Proposed MBS item descriptor for retinal photography in people with diabetes for use by practitioners other than specialists/optometrists and by appropriately trained non-medical operators

| |
|--|
| Category 2 – DIAGNOSTIC PROCEDURES AND INVESTIGATIONS |
| And |
| Group A10 – OPTOMETRIC SERVICES |
| MBS [item number (Note: this will be assigned by the Department if listed on the MBS)] |
| Bilateral retinal photography with a non-mydratic retinal camera for initial or repeat assessment for presence or absence of diabetic retinopathy in people with medically diagnosed diabetes. |
| Fee: \$50.00 |
| Explanatory notes: |
| A fee may not be charged for an assessment where a previous medical diagnosis of diabetic retinopathy applies at the time of |

presentation, or for patients with visual impairment. Visual impairment is defined as distance vision of less than 6/12 in either eye, or a difference of more than two lines of vision between the two eyes at the time of presentation. Presenting distance vision means unaided distance vision or the vision obtained with the current spectacles or contact lenses, if normally worn for distance vision.

A fee may be charged for repeat assessment on the condition that two calendar years have elapsed since the previous presentation for retinal photography (except for Indigenous Australians where a restriction of one calendar year applies).

This item is intended for the provision of retinal photography with a non-mydratic retinal camera. Use of mydriasis by medical practitioners only is permitted if adequate photographs cannot be obtained through an undilated pupil (see note below regarding referral requirements).

Item usage is restricted to retinal photography within the primary care settings (eg general practitioner, Indigenous health and diabetes clinics) and cannot be co-claimed with any other eye procedure by optometrist or ophthalmologist.

Detection of any diabetic retinopathy must be followed by referral to an optometrist or ophthalmologist.

Where images are of inadequate quality for detection of diabetic retinopathy by the attending medical practitioner, referral to an optometrist or ophthalmologist for further assessment is indicated. The fee must not be charged when a referral is required due to inability to obtain photographs of adequate quality for grading.

Imaging procedure by a non-medical operator must be followed by referral if (a) it is not possible to obtain an image of adequate quality through undilated pupils; (b) diabetic retinopathy is detected.

Charging of a fee must be accompanied by a report detailing the presence or absence of diabetic retinopathy, based on photos of readable quality.

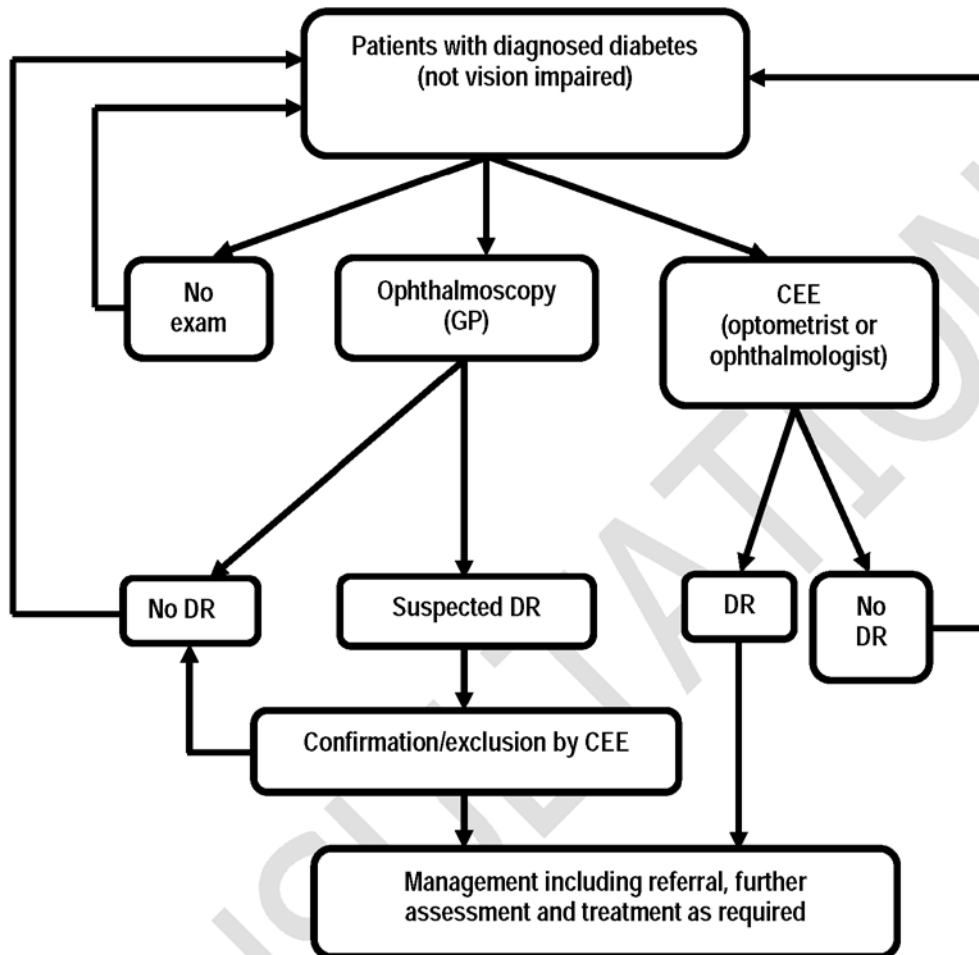
Clinical place for proposed intervention

The application submitted to MSAC indicated that the proposed Medicare service is not intended to replace or be used in conjunction with regular CEEs, but intended to address populations less likely to seek regular eye health examinations from optometrists or ophthalmologists. As a consequence PASC has advised that the service should be made available to all persons with diagnosed diabetes who do not have visual impairment, regardless of their previous eye examination history. The most appropriate comparator, according to the applicant, is the absence of regular CEEs. PASC has considered this proposal, and with support from HESP, regard standard medical assessment, i.e fundus examination through dilated pupils, using slit lamp biomicroscopy (by an optometrist) or ophthalmoscopy (by a GP), as additional comparators for inclusion in the submission based assessment of RP-NMRC.

The current Australian NHMRC guidelines for the management of DR emphasise the importance of regular clinical assessments in asymptomatic patients at risk of developing DR. These guidelines recommend two-yearly and yearly vision assessments for non-Indigenous and Indigenous Australians with diabetes, respectively, and retinal examinations in asymptomatic patients with diagnosed diabetes (i.e those without visual impairment) at the same frequency. This is because treatable retinopathy is commonly asymptomatic and timely treatment is the key to preventing vision loss and blindness. The algorithms in Figure 4 and Figure 4 have been produced based on revised algorithms from the applicant (CERA) and advice from HESP and PASC on the first draft of the protocol. It should be noted that a comprehensive eye examination (CEE) with an optometrist/ophthalmologist includes slit-lamp examination and/or retinal photography *with* mydriasis. No specific MBS item number exists for the use of non-

mydriatic retinal photography²², and in billing terms CEE and retinal photography are commonly considered separate events, i.e a Medicare-billed comprehensive eye examination does not cover retinal photography. Thus, taking retinal photographs currently incurs a charge at private rates outside Medicare.

Figure 4: Management algorithm for detection of diabetic retinopathy in patients with diagnosed diabetes in the absence of the proposed service i.e retinal photography using a non-mydriatic retinal camera

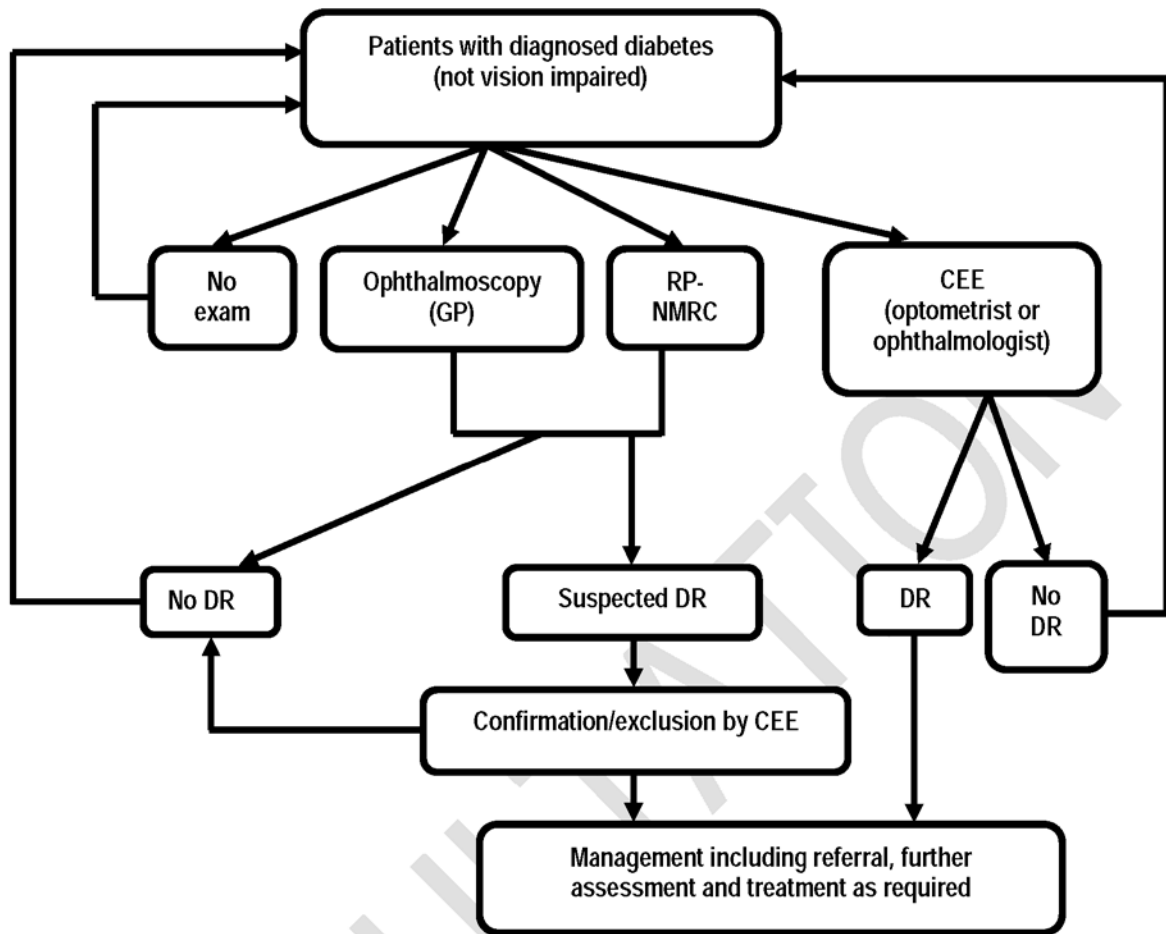


Abbreviations: CEE, comprehensive eye examination; DR, diabetic retinopathy; GP, general practitioner.

Note: CEE by an optometrist or ophthalmologist will include fundus examination using a slit-lamp biomicroscope and may also involve retinal photography with use of mydriasis; examination conducted by a GP through an ophthalmoscope may also involve instillation of a mydriatic in the eyes. Either service option should be repeated every two years and yearly among non-Indigenous and Indigenous persons with diabetes, respectively (as per NHMRC guidelines on DR). "No exam" means no eye examination beyond visual acuity testing.

²² Note: not to be confused with "retinal photography" as described in MBS item numbers 11215 and 11218, which in fact refer to the diagnostic method more widely referred to as fluorescein angiography.

Figure 5: Management algorithm for detection of diabetic retinopathy in patients with diagnosed diabetes, with proposed service available i.e retinal photography using a non-mydriatric retinal camera



Abbreviations: CEE, comprehensive eye examination; RP-NMRC, retinal photography with a non-mydriatric retinal camera; DR, diabetic retinopathy; GP, general practitioner

Note: CEE by an optometrist or ophthalmologist will include fundus examination using a slit-lamp biomicroscope and may also involve retinal photography with use of mydriasis; examination conducted by a GP through an ophthalmoscope may also involve instillation of a mydratric in the eyes. NHMRC guidelines on DR recommend CEE and ophthalmoscopy are repeated every two years and yearly among non-Indigenous and Indigenous persons with diabetes, respectively (as per NHMRC guidelines on DR). Maximum frequency for the proposed RP-NMRC service is the same as recommended for comparator services among the respective populations. "No exam" means no eye examination beyond visual acuity testing.

Comparators

The most commonly used diagnostic intervention for diabetic retinopathy at present is a CEE, performed either by an ophthalmologist or optometrist, which includes visual acuity testing and an ocular fundus examination through dilated pupils (mydriasis). The new RP-NMRC service could be used in place of, or in conjunction with regular CEEs, as effectively RP-NMRC would be used as a triage test, i.e for instances where no evidence of DR is detected, a CEE would not be considered necessary, whereas any sign of DR would be an indication for referral to CEE. The appropriate comparators for the assessment of RP-NMRC, as agreed to by PASC, are

- Standard medical assessment, either:
 - a) CEE (includes slit lamp biomicroscopy of the fundus) by an optometrist or ophthalmologist, with or without mydriasis; or
 - b) ophthalmoscopy with mydriasis by a GP.
- No eye examination beyond visual acuity testing.

Outcomes for safety and effectiveness evaluation

The applicant claims that the impact of the proposed RP-NMRC service will be primarily via increased detection of disease and decreased adverse events resulting from delayed diagnosis of DR. This would lead to the initiation of treatment in patients who would not have been treated in the absence of RP-NMRC. Most would be cases of DR, but approximately 30 per cent²³ would be incidental findings of non-DR ocular disorders requiring treatment, such as age-related macular degeneration. While PASC acknowledged that identification of incidental findings may be a benefit from RP-NMRC, it was decided that non-DR outcomes are not the primary interest for this assessment and that the consequences of incidental findings resultant from providing an RP-NMRC service in the primary care setting should be mentioned in the text of the assessment report, but not included in the economic modelling. The applicant has stated that due to similar accuracy of RP-NMRC and ophthalmoscopy findings for the presence or absence of DR, it is possible to draw conclusions regarding the clinical significance or impact of RP-NMRC on health outcomes using a linked evidence approach.

PASC have advised that outcomes for the submission based assessment should focus on determining the impact on subsequent referral for CEE as a result of increased testing

²³ HESP advice provided at PASC meeting 15th August 2013.

for the detection of DR, indicating that a linked evidence approach would be appropriate. As it is probable that RP-NMRC is not as accurate as CEE (the gold standard), it is unlikely that patients with a different spectrum of eye disease would be identified with RP-NMRC. Thus, the currently available treatment options for DR would remain appropriate for use (and be effective) in patients with DR initially identified by RP-NMRC. An assessment of treatment effectiveness in DR patients identified by RP-NMRC would, therefore, not be required in the assessment of RP-NMRC submitted to MSAC.

Linked evidence

The outcomes, upon which the comparative performance of RP-NMRC vs. standard medical assessment will be measured, are:

Safety²⁴

- Physical and psychological harms from DR testing
- Mydriasis-related harms (associated with comparators)

Diagnostic accuracy

- Measures of test performance (eg sensitivity, specificity, negative and positive predictive values, false positive and false negative rates)
- Measures of test concordance (eg kappa measures, agreement measures) (in the absence of/limited test performance data), including subgroup analysis of
- Rate of unreadable photographs or inability to make a diagnosis
- Subgroup analyses of the above diagnostic accuracy measures according to reader area of medical specialization, where possible

Effectiveness (based on change in management)

- Change in rate of appropriate referral for CEE – for DR and non-DR ocular disorders and vision impairment/loss, separately and combined
- Reduction in unnecessary referral
- Compliance with referral to CEE

²⁴The applicant has stated that RP-NMRC is considered a safe technology. It is also stated that there are many potential barriers to compliance with the current guideline that recommends regular dilated fundus exams for patients with diabetes. One frequently reported barrier to regular dilated fundus exams is the reluctance to undergo mydriasis, which some individuals avoid and others find inconvenient and/or uncomfortable. By contrast, the applicant claims that RP-NMRC is a safe, simple, and convenient alternative to mydriatic eye exams for the diagnosis of DR in those who do not have regular eye exams.

Question for consultation: PASC have indicated that changes to management due to increased detection of DR are of most importance and interest for the assessment. However, prior to finalising outcomes, PASC will consider public comment on whether or not non-DR events should be included. If non-DR events are included, what is the rate of non-DR findings which are referred on?

Summary of PICO to be used for assessment of evidence (systematic review)

Table 7 provides a summary of the PICO used to:

- (1) define the question for public funding,
- (2) select the evidence to assess the safety and effectiveness of RP-NMRC in people with diabetes, and
- (3) provide the evidence-based inputs for any decision-analytical modelling to determine the cost-effectiveness of RP-NMRC in people with diabetes.

Table 7: Summary of PICO to define research questions that assessment will investigate

| Population | Intervention | Comparator | Reference standard | Outcomes to be assessed |
|--|--------------|--|--|--|
| Patients with a diagnosis of diabetes and no visual impairment | RP-NMRC | Standard medical assessment: a) CEE by an ophthalmologist or optometrist (includes slit lamp examination of the fundus with/without mydriasis b) Ophthalmoscopy by a GP, with mydriasis No eye examination beyond visual acuity testing | CEE by an ophthalmologist/optometrist. The gold standard photographic method for diagnosis of retinopathy uses seven overlapping stereoscopic fields with an angle of view of 30 degrees. | <u>Safety</u> Potential physical and psychological harms from testing Reluctance to undergo mydriasis <u>Diagnostic Accuracy</u> Measures of test performance (eg sensitivity, specificity, NPV, PPV, false positive and false negative rates Measures of test concordance (eg kappa measures, agreement measures) Rate of unreadable photographs or inability to make a diagnosis |

| | | | | |
|--|--|--|--|--|
| | | | | <p><u>Effectiveness (based on change in management)</u></p> <p>Change in rate of appropriate referral for CEE – for DR and non-DR ocular disorders and vision impairment/loss, separately and combined</p> <p>Reduction in unnecessary referral</p> <p>Compliance with referral to CEE</p> <p><u>Cost-effectiveness</u></p> <p>Cost per gain in quality adjusted life years (QALY), cost per health outcome gained</p> |
|--|--|--|--|--|

Questions for public funding

What is the safety, effectiveness, and cost-effectiveness of RP-NMRC compared with standard medical assessment?

What is the diagnostic accuracy of RP-NMRC compared against the reference standard of CEE?

Does the availability of RP-NMRC result in a change in patient management?

If the availability of RP-NMRC results in a change in patient management, is this change associated with improved downstream health outcomes?

Abbreviations: RP-NMRC, retinal photography using a non-mydratic camera; CEE, comprehensive eye examination; NPV, negative predictive value; PPV, positive predictive value

Clinical claim

The applicant claims that RP-NMRC is more effective than no eye examination in identifying additional cases of DR. Since RP-NMRC is also considered a safe technology and claimed to have no major adverse effects, the comparative safety has been classified as ‘non-inferior’. On this basis a cost effectiveness analysis or a cost utility analysis would be required (see Table 8). However, PASC has suggested that the effectiveness of RP-NMRC should also be compared to CEE and ophthalmoscopy. If the effectiveness of RP-NMRC is found to be no worse than these comparator interventions, and the safety is found to be similar, a cost-minimisation analysis would be required.

Table 8: Classification of an intervention for determination of economic evaluation to be presented

| | | Comparative effectiveness versus comparator | | | | |
|--------------------------------------|--------------|---|----------|--------------|----------------------|----------|
| | | Superior | | Non-inferior | Inferior | |
| Comparative safety versus comparator | Superior | CEA/CUA | | CEA/CUA | Net clinical benefit | CEA/CUA |
| | | | | | Neutral benefit | CEA/CUA* |
| | | | | | Net harms | None^ |
| | Non-inferior | CEA/CUA | | CEA/CUA* | None^ | |
| | Inferior | Net clinical benefit | CEA/CUA | None^ | None^ | |
| | | Neutral benefit | CEA/CUA* | | | |
| Net harms | | None^ | | | | |

Abbreviations: CEA = cost-effectiveness analysis; CUA = cost-utility analysis

* May be reduced to cost-minimisation analysis. Cost-minimisation analysis should only be presented when the proposed service has been indisputably demonstrated to be no worse than its main comparator(s) in terms of both effectiveness and safety, so the difference between the service and the appropriate comparator can be reduced to a comparison of costs. In most cases, there will be some uncertainty around such a conclusion (i.e., the conclusion is often not indisputable). Therefore, when an assessment concludes that an intervention was no worse than a comparator, an assessment of the uncertainty around this conclusion should be provided by presentation of cost-effectiveness and/or cost-utility analyses.

^ No economic evaluation needs to be presented; MSAC is unlikely to recommend government subsidy of this intervention.

Outcomes and health care resources affected by introduction of proposed intervention

Outcomes for economic evaluation

The application has indicated that the main role of RP-NMRC is to identify additional cases of DR, which would enable the initiation of treatment in patients who would not have been treated, or received delayed treatment in the absence of RP-NMRC²⁵. Therefore, cost per gain in quality-adjusted life-years (QALYs) and cost per health outcome gained would be appropriate outcomes for the economic evaluation. PASC's position is that the economic evaluation will not consider the consequences of non-DR events identified using RP-NMRC (although is seeking public consultation feedback). The applicant claims that there are few adverse effects associated with RP-NMRC, but that there may be an 'after image' that persists for a few seconds. A comparison between the intervention and the comparator in terms of costs associated with adverse events should be included in the modelling. The economic assessment will also need to take into account potential Extended Medicare Safety Net (EMSN) benefits, given that no EMSN expenditure applies to comparator services provided by optometrists.

²⁵ Not all patients will opt for treatment and will be lost to follow-up.

PASC have requested that sub-group analyses be provided to differentiate between the different groups who interpret the photographs.

Health care resources

The list of resources to be considered in the economic analyses is outlined in Table 9 below. This includes resources required for a CEE, ophthalmoscopy and RP-NMRC.

FINAL

Table 9: List of resources to be considered in the economic analysis

| | Provider of resource | Setting in which resource is provided | Proportion of patients receiving resource | Number of units of resource per relevant time horizon per patient receiving resource | Disaggregated unit cost | | | | | |
|---|--|--|--|---|-------------------------|--------------|-------------------|------------------------|---------|------------|
| | | | | | MBS | Safety nets* | Other govt budget | Private health insurer | Patient | Total cost |
| <u>Resources provided to deliver proposed intervention</u> | | | | | | | | | | |
| Acquisition of images using a non-mydriatic retinal camera | Appropriately trained staff (e.g. health worker, technician) OR general practitioner | Various primary care settings | Initially, 100% + All patients who continue to screen negative for DR receive ongoing RP-NMRC; those positive for DR referred | 1 RP-NMRC service per patient every 2 years (every year for Indigenous patients), as per NHMRC guidelines | Proposed item \$50 | TBD | | | | \$50 |
| Professional consultation | General practitioner | | Initially 100% + All patients who continue to screen negative for DR | 2-yearly per patient (yearly if Indigenous) | | | | | | |
| <u>Resources provided in association with the proposed intervention</u> | | | | | | | | | | |
| Reading of images | General practitioner OR Optometrist OR Ophthalmologist OR Trained (non-medical) reader (?) | Clinic, consulting rooms (may be performed remotely) | Initially 100% + All patients who continue to screen negative for DR | 2-yearly per patient (yearly if Indigenous) | | TBD | | | | |
| <u>Resources provided following the proposed intervention</u> | | | | | | | | | | |
| CEE | Optometrist OR ophthalmologist | Consulting rooms | Majority of patients who screen positive for DR referred for CEE (some DR patients may be appropriately managed within | Max 1 service per patient every 2 years (every year for Indigenous patients) | | | | | | |

| | Provider of resource | Setting in which resource is provided | Proportion of patients receiving resource | Number of units of resource per relevant time horizon per patient receiving resource | Disaggregated unit cost | | | | | |
|---|----------------------|---------------------------------------|---|--|--|--------------|--|------------------------|---|------------|
| | | | | | MBS | Safety nets* | Other govt budget | Private health insurer | Patient | Total cost |
| | | | optometric practice alone) | | | | | | | |
| Ophthalmologist - retinopathy requiring treatment - laser photocoagulation, and/or - anti-VEGF treatment (costs include drug acquisition and administration of intravitreal injections) | Ophthalmologist | Consulting rooms | | 1 or more courses depending on patient's response to therapy ^a | Photocoagulation item: Item no. 42809 \$451.10 \$338.35 (75%) \$383.45 (85%) Administration of intravitreal injection items: Item no. 42738 \$295.15 \$221.40 (75%) \$250.90 (85%) Item no. 42739 \$295.15 \$221.40 (75%) \$250.90 (85%) Item number 42740 \$295.15 | | Anti-VEGF treatments are not PBS approved for treatment of the complications of DR | | For this indication, anti-VEGF treatment is an "out-of-pocket" cost | |

| | Provider of resource | Setting in which resource is provided | Proportion of patients receiving resource | Number of units of resource per relevant time horizon per patient receiving resource | Disaggregated unit cost | | | | | | |
|--|---|---------------------------------------|---|--|--|--------------|--|------------------------|---------|---|--|
| | | | | | MBS | Safety nets* | Other govt budget | Private health insurer | Patient | Total cost | |
| | | | | | \$221.40 (75%) \$250.90 (85%) | | | | | | |
| <u>Resources provided to deliver ophthalmoscopy (as alternative to RP-NMRC)</u> | | | | | | | | | | | |
| Consultation with general practitioner | General practitioner | Consulting rooms | | 1 service per patient every 2 years (every year for Indigenous patients) | | | | | | | |
| <u>Resources provided in association with ophthalmoscopy (as alternative to RP-NMRC)</u> | | | | | | | | | | | |
| Mydriatic agent(s) ^b (adequate fundus examination with an ophthalmoscope is considered limited without mydriasis) ^c | General practitioner Not available through the PBS | Consulting rooms | | Max 1 unit of mydriatic per patient every 2 years (every year for Indigenous patients) | | | TBD Supply arrangement will need to be researched | | | | |
| <u>Resources provided to deliver CEE (as alternative to RP-NMRC)</u> | | | | | | | | | | | |
| Consultation with optometrist or ophthalmologist, including slit lamp biomicroscopy (retinal photography using mydriasis may also be applicable) | Optometrist OR ophthalmologist | Consulting rooms | | 1 service per patient every 2 years (every year for Indigenous patients) | Item no. 10915 \$71.00 \$60.35 (85%) Item no. 10916 \$35.55 \$30.25 (85%) | | | | | Retinal photography is an additional cost to the patient (i.e. may be conducted but not billed as part of the comprehensive exam) | |
| <u>Resources provided in association with CEE (as alternative to RP-NMRC)</u> | | | | | | | | | | | |
| Acquisition and reading | Optometrist | Consulting | All patients who | 1 service per | | | | | | Retinal photography is | |

| | Provider of resource | Setting in which resource is provided | Proportion of patients receiving resource | Number of units of resource per relevant time horizon per patient receiving resource | Disaggregated unit cost | | | | | |
|--|---|---------------------------------------|---|--|-------------------------|--------------|--|------------------------|--|------------|
| | | | | | MBS | Safety nets* | Other govt budget | Private health insurer | Patient | Total cost |
| of retinal images (if retinal photography with comprehensive exam) | OR ophthalmologist PBS | rooms | continue to screen negative for DR receive ongoing exams; patients who screen positive receive treatment as necessary | patient every 2 years (every year for Indigenous patients) | | | | | an additional cost to the patient (i.e. may be conducted but not billed as part of the comprehensive exam) | |
| Mydriatic agent(s) | Optometrist OR Ophthalmologist Not available through the PBS | Consulting rooms | | Max 1 unit of mydriatic per patient every 2 years (every year for Indigenous patients) | | | TBD Supply arrangement will need to be researched | | | |

Abbreviations: RP-NMRC, retinal photography using a non-mydriatic camera; CEE, comprehensive eye examination; TBD, to be determined; PBS, pharmaceutical

*Include costs relating to both the standard and extended safety net.

^aRetinal photocoagulation may be conducted in some cases of more advanced DR. This can include thousands of laser shots over several visits, and success can often only be measured over time (HESP advice [optometrist] received 2nd April 2013).

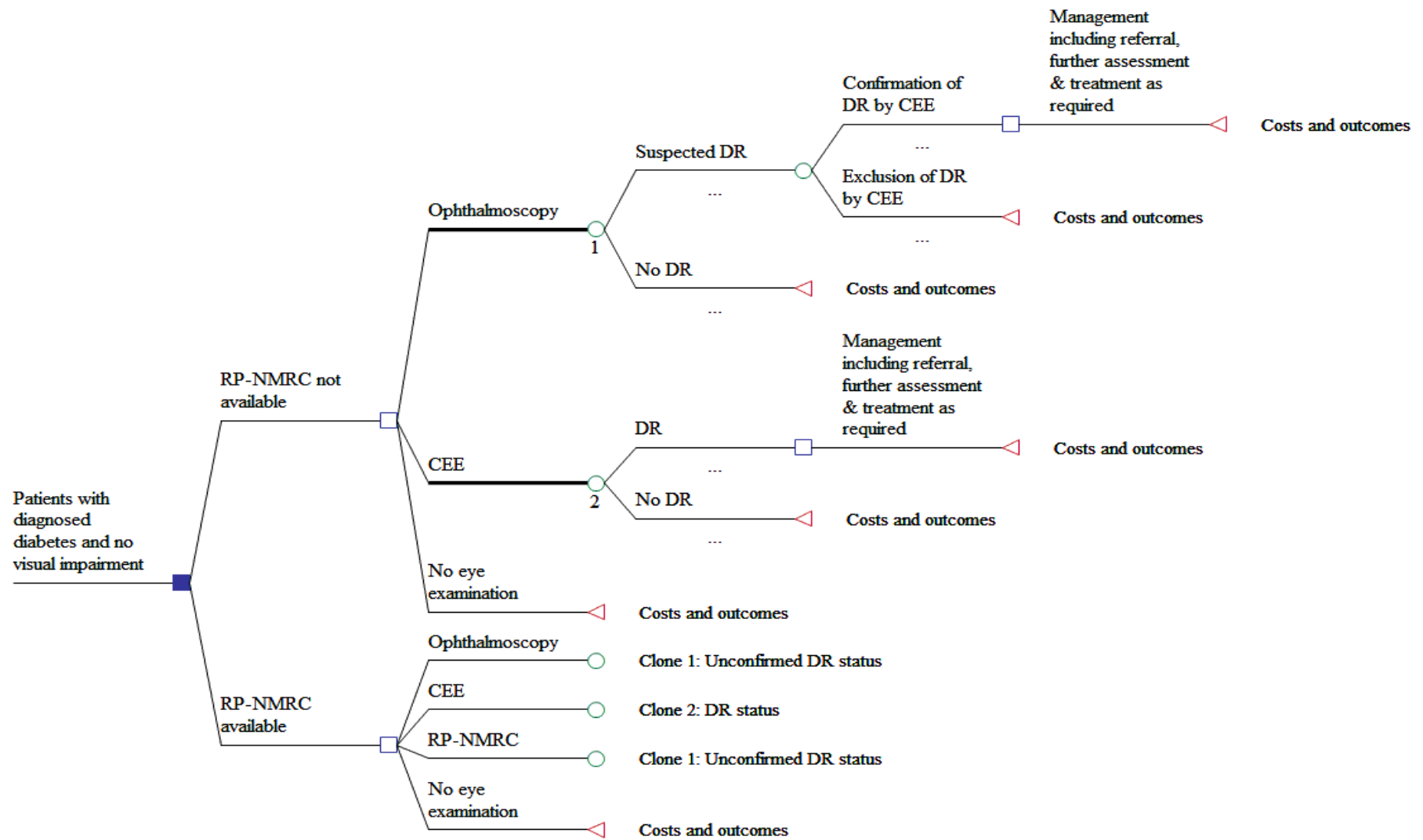
^bTropicamide solution 0.5% or 1.0%, and/or phenylephrine solution 2.5% (HESP [optometrist, ophthalmologist] advice, personal correspondence 2nd and 5th April 2013).

^cHESP (optometrist) advice, personal correspondence received 2nd April 2013.

Proposed structure of economic evaluation (decision-analytic)

The decision analytic is shown at Figure 6. Under the proposed listing of RP-NMRC on the MBS, all patients will have been confirmed to be eligible for the service based on blood tests to diagnose diabetes. The decision analytic is intended to capture all options for the clinical management of patients with diagnosed diabetes with respect to detection of DR in scenarios where RP-NMRC is: (a) available; and (b) unavailable. This will provide a basis for determination of differences in the relevant patient outcomes and cost.

Figure 6: Decision analytic showing scenarios for which non-mydratiac retinal photography is either available/unavailable for the detection of diabetic retinopathy



Abbreviations: RP-NMRC, retinal photography using a non-mydratiac retinal camera; DR, diabetic retinopathy

References

AAO 2008, *Preferred Practice Pattern Guidelines, Diabetic Retinopathy*, American Academy of Ophthalmology Retina Panel, viewed February 2013, <www.aao.org/ppp>.

AIHW 2011, *Diabetes prevalence in Australia: detailed estimates for 2007–08. Diabetes series no. 17. Cat. no. CVD 56.*, Australian Institute of Health and Welfare, Canberra, viewed March 2013, <<http://www.aihw.gov.au/publication-detail/?id=10737419311>>.

Aung, KZ, Robman, L, Chong, EW, English, DR, Giles, GG & Guymer, RH 2009, 'Non-mydratic digital macular photography: how good is the second eye photograph?', *Ophthalmic Epidemiol*, vol. 16, no. 4, Jul-Aug, pp. 254-261.

Baeza, M, Orozco-Beltran, D, Gil-Guillen, VF, Pedrera, V, Ribera, MC, Pertusa, S & Merino, J 2009, 'Screening for sight threatening diabetic retinopathy using non-mydratic retinal camera in a primary care setting: to dilate or not to dilate?', *Int J Clin Pract*, vol. 63, no. 3, Mar, pp. 433-438.

Biographix 2006, *Eye*, Biographix Media, viewed March 2013, <www.biographixmedia.com/>.

Cassin, B & Rubin, M 2011, *Dictionary of Eye Terminology*, Sixth edn, Triad Publishing, Gainesville, Florida, USA.

Clark, A, Morgan, WH, Kain, S, Farah, H, Armstrong, K, Preen, D, Semmens, JB & Yu, DY 2010, 'Diabetic retinopathy and the major causes of vision loss in Aboriginals from remote Western Australia', *Clin Experiment Ophthalmol*, vol. 38, no. 5, Jul, pp. 475-482.

Curtis, TM, Gardiner, TA & Stitt, AW 2009, 'Microvascular lesions of diabetic retinopathy: clues towards understanding pathogenesis?', *Eye (Lond)*, vol. 23, no. 7, Jul, pp. 1496-1508.

Hansen, AB, Hartvig, NV, Jensen, MS, Borch-Johnsen, K, Lund-Andersen, H & Larsen, M 2004, 'Diabetic retinopathy screening using digital non-mydratic fundus photography and automated image analysis', *Acta Ophthalmol Scand*, vol. 82, no. 6, Dec, pp. 666-672.

Harper, CA, Livingston, PM, Wood, C, Jin, C, Lee, SJ, Keeffe, JE, McCarty, CA & Taylor, HR 1998, 'Screening for diabetic retinopathy using a non-mydratic retinal camera in rural Victoria', *Aust N Z J Ophthalmol*, vol. 26, no. 2, May, pp. 117-121.

Heaven, CJ, Cansfield, J & Shaw, KM 1993, 'The quality of photographs produced by the non-mydratic fundus camera in a screening programme for diabetic retinopathy: a 1 year prospective study', *Eye (Lond)*, vol. 7 (Pt 6), pp. 787-790.

Ku, JJ, Landers, J, Henderson, T & Craig, JE 2013, 'The reliability of single-field fundus photography in screening for diabetic retinopathy: the Central Australian Ocular Health Study', *Med J Aust*, vol. 198, no. 2, Feb 4, pp. 93-96.

Larizza, MF, Hodgson, LA, Fenwick, EK, Kawasaki, R, Audehm, R, Wang, JJ, Wong, TY & Lamoureux, EL 2013, 'Feasibility of screening for diabetic retinopathy at an Australian pathology collection service: a pilot study', *Med J Aust*, vol. 198, no. 2, Feb 4, pp. 97-99.

Lopez-Bastida, J, Cabrera-Lopez, F & Serrano-Aguilar, P 2007, 'Sensitivity and specificity of digital retinal imaging for screening diabetic retinopathy', *Diabet Med*, vol. 24, no. 4, Apr, pp. 403-407.

Mitchell, P, Bandello, F, Schmidt-Erfurth, U, Lang, GE, Massin, P, Schlingemann, RO, Sutter, F, Simader, C, Burian, G, Gerstner, O, Weichselberger, A & group, Rs 2011, 'The RESTORE study: ranibizumab monotherapy or combined with laser versus laser monotherapy for diabetic macular edema', *Ophthalmology*, vol. 118, no. 4, Apr, pp. 615-625.

Neubauer, AS & Ulbig, MW 2007, 'Laser treatment in diabetic retinopathy', *Ophthalmologica*, vol. 221, no. 2, pp. 95-102.

NHMRC 2008, *Guidelines for the Management of Diabetic Retinopathy*, National Health and Medical Research Council, viewed February 2013, <<http://www.nhmrc.gov.au/guidelines/publications/di15>>.

Phiri, R, Keeffe, JE, Harper, CA & Taylor, HR 2006, 'Comparative study of the polaroid and digital non-mydratic cameras in the detection of referable diabetic retinopathy in Australia', *Diabet Med*, vol. 23, no. 8, Aug, pp. 867-872.

Schiffelers, RM, Fens, MH, van Blijswijk, JM, Bink, DI & Storm, G 2007, 'Targeting the retinal microcirculation to treat diabetic sight problems', *Expert Opin Ther Targets*, vol. 11, no. 11, Nov, pp. 1493-1502.

Siu, SC, Ko, TC, Wong, KW & Chan, WN 1998, 'Effectiveness of non-mydratic retinal photography and direct ophthalmoscopy in detecting diabetic retinopathy', *Hong Kong Med J*, vol. 4, no. 4, Dec, pp. 367-370.

Soliman, AZ, Silva, PS, Aiello, LP & Sun, JK 2012, 'Ultra-wide field retinal imaging in detection, classification, and management of diabetic retinopathy', *Semin Ophthalmol*, vol. 27, no. 5-6, Sep-Nov, pp. 221-227.

Tapp, RJ, Shaw, JE, Harper, CA, de Courten, MP, Balkau, B, McCarty, DJ, Taylor, HR, Welborn, TA, Zimmet, PZ & AusDiab Study, G 2003, 'The prevalence of and factors associated with diabetic retinopathy in the Australian population', *Diabetes Care*, vol. 26, no. 6, Jun, pp. 1731-1737.

Taylor, H, Keeffe, J, Arnold, A, Dunn, R, Fox, S, Goujon, N, Xie, J, Still, R, Burnett, A, Marolia, M, Shemesh, T, Carrigan, J & Stanford, E 2009, *National Indigenous Eye Health Study - Minum Barreng (Tracking Eyes)*, University of Melbourne.

Thomas, BJ, Shienbaum, G, Boyer, DS & Flynn, HW, Jr. 2013, 'Evolving strategies in the management of diabetic macular edema: clinical trials and current management', *Can J Ophthalmol*, vol. 48, no. 1, Feb, pp. 22-30.

Williams, GA, Scott, IU, Haller, JA, Maguire, AM, Marcus, D & McDonald, HR 2004, 'Single-field fundus photography for diabetic retinopathy screening: a report by the American Academy of Ophthalmology', *Ophthalmology*, vol. 111, no. 5, May, pp. 1055-1062.

Xie, J, Arnold, AL, Keeffe, J, Goujon, N, Dunn, RA, Fox, S & Taylor, HR 2011, 'Prevalence of self-reported diabetes and diabetic retinopathy in indigenous Australians: the National Indigenous Eye Health Survey', *Clin Experiment Ophthalmol*, vol. 39, no. 6, Aug, pp. 487-493.

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