VISION 2020 THE RIGHT TO SIGHT AUSTRALIA

ACCESS ECONOMICS Pty Limited

Clear Focus

The Economic Impact of Vision Loss in Australia in 2009

A report prepared for Vision 2020 Australia
by Access Economics Pty Limited

June 2010

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This report has been prepared by Vision 2020 Australia, in collaboration with Access Economics and the project steering committee.

The financial support of members including the Brien Holden Vision Institute, Optometrists Association Australia, The Royal Australian and New Zealand College of Ophthalmologists and Vision Australia, as well as Alcon Australia and Pfizer Australia is gratefully acknowledged.

Vision 2020 Australia is a national body working in partnership to prevent avoidable blindness and improve vision care.

Vision 2020 Australia, Melbourne, Australia, June 2010

ISBN 978-0-9808202-0-1

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Glossary

ABS	Australian Bureau of Statistics
ACHI	Australian Classification of Health Interventions
AE-DEM	Access Economics Demographic Model
AEM	Access Economics Macroeconomic Model
AIHW	Australian Institute of Health and Welfare
AMD	age-related macular degeneration
AMWAC	Australian Medical Workforce Advisory Committee
AUSDIAB	Australian Diabetes, Obesity and Lifestyle Study
AWE	average weekly earnings
BMES	Blue Mountains Eye Study
CERA	Centre for Eye Research Australia
CNV	choroidal neovascularisation
COAG	Council of Australian Governments
DALY	disability adjusted life year
DEN	disability employment network
DM	diabetes mellitus
DoHA	Department of Health and Ageing
DR	diabetic retinopathy
DSP	Disability Support Pension
DWL	deadweight loss
GA	geographic atrophic
GDP	gross domestic product
GP	General Practitioner
HACC	Home and Community Care
IGR3	Third Intergenerational Report
MABEL	Medicine in Australia: Balancing Employment and Life longitudinal survey
MEG	minority ethnic group
MVIP	Melbourne Visual Impairment Project
NEHI	National Eye Health Initiative
NHS	National Health Survey
NHHRC	National Health and Hospitals Reform Commission
NHMRC	National Health and Medical Research Council

NSA	Newstart Allowance
OECD	Organisation for Economic Cooperation and Development
PBS	Pharmaceutical Benefits Scheme/Schedule
QALY	quality adjusted life year
RE	refractive error
RPE	retinal pigment epithelium
SCRGSP	Steering Committee for the Review of Government Service Provision
SDAC	Survey of Disability, Ageing and Carers
URE	uncorrected refractive error
VEGF	vascular endothelial growth
VITP	Vision Impaired Travel Pass
VSL	value of a statistical life
VSLY	value of a statistical life year
WHA	World Health Assembly
WHO	World Health Organisation
WTP	willingness-to-pay
YLD	years lived with disability
YLL	(healthy) years of life lost

Executive Summary

In Australia in 2009, there were almost 575,000 Australians aged 40 or over with vision loss. This equates to 5.8% of the Australian population in that age group. Of these, around 66,500 people were blind. Of the 575,000 people with vision loss the largest proportion were aged 70 or over (nearly 70%).

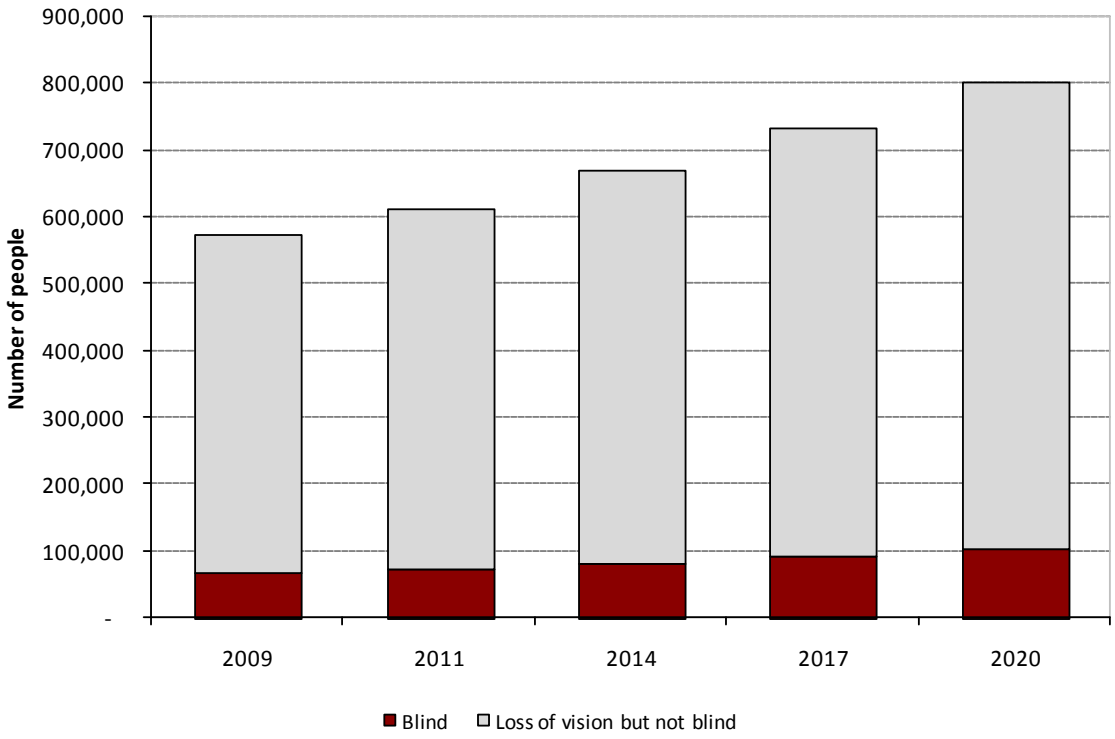
Most vision loss (over 341,000 people or 59%) was caused by uncorrected refractive error (excluding presbyopia). Cataract caused 15% of vision loss, age-related macular degeneration (AMD) 10%, glaucoma 5% and diabetic retinopathy (DR) 2%. The most common causes of blindness were AMD (50%), glaucoma (16%) and cataract (12%). In addition to the 575,000 people with vision loss, approximately 73,000 people had presbyopia[1] in 2009.

Low vision is associated with a higher than average risk of mortality because it is correlated with a higher risk of falls, motor vehicle accidents and depression (Centre for Eye Research Australia and Access Economics 2004). Over 1,100 deaths were attributable to vision loss in 2009.

It is projected that the number of people aged 40 or over with vision loss will rise to almost 801,000 by 2020 and those who are blind will rise to 102,750. In addition, the number of people with presbyopia is projected to rise to almost 90,000 by 2020. The projected rise in prevalence reflects demographic ageing, and assumes a policy-neutral environment. The rise in the number of Australians is depicted in Chart i.

[1] Presbyopia (age-related near sightedness) was not included in the previous report (Centre for Eye Research Australia and Access Economics 2004), however prevalence rates have been included in this report as stand alone figures only.

Chart i: Projections of Australians aged 40 or over with vision loss



In 2009, the total financial cost of vision loss (excluding loss of wellbeing) was estimated to be $7.2 billion, or $12,556 per person with vision loss.

- In 2009, total health system expenditure on disorders of the eye and adnexa was estimated at $2.98 billion or $5,183 per person with vision loss aged over 40. The component of health system costs that can be allocated to specific diseases are alone projected to rise from $2,580 million in 2009 to $4,766 million by 2020.
- Productivity losses of those with low vision and blindness were approximately $2.3 billion in 2009. This included losses due to lower than average employment rates (adjusted for age) of those with low vision, losses resulting from premature mortality, and the 'bring forward' of employer search and hiring costs due to premature mortality
- Productivity losses of family and friends who care for people with low vision and blindness on an unpaid basis were around $251 million. This reflects the opportunity cost of informal carers' time.
- The costs of aids, home modifications, other types of care and the 'bring forward' of funeral costs were approximately $839 million in 2009.
- Deadweight losses (the economic cost associated with administering the taxation and transfer system and which also arises because of distortions to behaviour) were estimated to be $869 million in 2009.

The loss of wellbeing that results from low vision and blindness was estimated using Disability Adjusted Life Years (DALYs),[2] which incorporate the detriment to health, as well as premature mortality. In 2009, low vision was associated with almost 58,150 DALYs — 6,738 years of life lost due to premature death and 51,409 years of life lived with disability.

- The monetary value of the loss of well being in 2009 was $9.4 billion. If this is added to the financial costs, the overall cost of vision loss in 2009 was $16.6 billion, or $28,917 per person with vision loss aged over 40.

Presbyopia is included in the health system cost estimates in this report, but not the indirect financial costs. Presbyopia may affect loss of wellbeing however there are currently no disability weights for this condition and further research is required to understand the impact of presbyopia on wellbeing.

Many Australians are needlessly experiencing vision loss. Improving awareness about how to avoid vision loss, and ensuring access to eye care services including prevention, treatment and rehabilitation services are important.

Moreover, quality of life and independence of those living with vision loss can be improved through rehabilitation, aids and equipment which enhance vision and improve functionality.

Eliminating avoidable vision loss would substantially reduce the associated costs.

Australia has joined with other countries in the drive to eliminate avoidable blindness by 2020. *VISION 2020: The Right to Sight* is a collaborative effort between World Health Organisation (WHO) and a number of partners. However, in the current reform environment, this goal is in danger of being lost.

An analysis of the foreshadowed health reforms was conducted with a view to investigating the implications for Australians' eye health. The findings are summarised as follows.

System structure

While funding for hospitals, primary care and aged care will be centralised within the Commonwealth purview, responsibility for care of young people with a disability will remain with State and Territory governments. New agencies and organisations are being established — for example, Medicare Locals, GP Super Clinics, local hospital networks, the National Preventive Health Agency, and Health Workforce Australia.

- Fragmentation will remain a key issue for the health system, as well as for government agencies more broadly.
- Fragmented funding and service delivery is a considerable challenge for people with vision loss or who have low vision or blindness. They need a range of health, disability, aged care, education, housing, employment and transport services. Lack of coordination and cooperation can have adverse outcomes for people with vision loss.

[2] Note that the term 'loss of wellbeing' is used throughout this report instead of the well defined concept in health economics, 'burden of disease' as measured by disability adjusted life years (DALYs). It measures the suffering and premature death from a disease or injury and does not imply that people experiencing disease or injury are a burden on society.

The need for evidence, evaluation and data

Ongoing high quality epidemiological, clinical, economic, health services and evaluation research is required to underpin eye health policy and practice. The recommendations for improving the evidence base endorsed by the Australian Health Ministers' Conference (2005) remain relevant.

Eye health needs to be incorporated into the preventive health research agenda as well as other longstanding research agendas.

It is not possible with current data sets available to gauge Australia's success in reducing avoidable blindness. This needs to be rectified. The heightened emphasis on transparency and reporting of outputs and outcomes as part of the health reform initiatives is welcomed. This should also be matched in the disability services sector. Increased efforts to coordinate data sets and continue expanding linkages across administrative data sets are to be applauded.

Vision as a public health issue

Vision health needs to be elevated as a public health issue (to the same level as smoking cessation or obesity). Eye health messages need to be included in all prevention campaigns, with messages targeted at 'at risk' populations.

- Promotion and prevention strategies need to be integrated and education of GPs, nurses and allied care professionals is an important complement to social marketing campaigns aimed at educating consumers. The primary health care workforce needs to be able to identify vision loss, detect eye disease and refer appropriately
- Regular eye health tests should be promoted. Regular eye examinations are required for early detection of eye disease and will reduce vision loss from AMD, diabetes and glaucoma. These tests are subsidised by Medicare.

Chronic disease

- Care of eye health needs to be integrated into primary health care chronic disease management programs. The initial focus on diabetes is welcomed, particularly as ophthalmic complications of diabetes have the highest hospitalisations of all diabetes complications.
- Current data suggest few people with diabetes receive regular eye exams consistent with the NHMRC guidelines (2008). Retinal photography needs to be encouraged. Use of retinal photography means it is easier to educate to achieve more effective diagnosis and it is very cost effective, saving $33.24 in the cost of each screen relative to more traditional diagnostic methods (Access Economics 2005a).

Acute care

- Public hospital elective surgery waiting times for ophthalmology procedures remain worse than average. Ophthalmology waiting times are not reported by urgency category, so it is not possible to judge whether patients wait longer than is recommended for ophthalmology care. Waiting list management and monitoring are still required to ensure patients do not wait unnecessarily long for cataract surgery. In addition, ophthalmology and procedural waiting lists need to be publicly reported by urgency category.

The workforce

- Addressing constraints on training, including in both the public and the private sector, is very important. In particular, to sustain the ophthalmologist workforce, there is a need for trainers who provide training services in private practices.
- There are similar constraints on the clinical training of optometrists; in respect of optometrists updating their abilities to use and prescribe scheduled medicines.
- The eye health workforce is not restricted to ophthalmologists and optometrists but includes GPs, ophthalmic nurses, orthoptists, optical dispensers and optical technicians. Rehabilitation workers, occupational therapists, orientation and mobility specialists, and employment consultants are also important in assisting people with vision loss to achieve independence and quality of life. The newly established agency 'Health Workforce Australia' needs to have as broad a remit as possible to ensure coordination and continuity of care — and to avoid the problems associated with fragmented funding and delivery systems.
- Eye care professionals and allied workers need to be included in the National Health Workforce Statistical Resource. In addition, eye care professionals and allied workers need to be included in the preventive health workforce audit and strategy.

Education and employment

- Education of people who are blind or partially sighted is at least as important as for other Australians in ensuring stability of income and participation in employment.
- In addition, the ability of those with vision loss to access information generally via Braille, electronic information formats, large print (with or without technology) is linked to their likelihood of employment.
- People with low vision or who are blind need access to appropriate employment services to expand their employment opportunities. In addition, Vision Australia (2007) recommendations to reduce barriers to employment need to be implemented.

Reform to the health system will take several years. However, the goal of eliminating avoidable blindness can still be achieved while reform is underway. Regular eye tests for early detection of eye disease are available and affordable and can ultimately reduce vision loss from cataract, refractive error, AMD, diabetes and glaucoma — the most common causes of vision loss in Australia.

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2010

1 Background

This report, commissioned by Vision 2020 Australia, the peak body for the eye health and vision care sector, estimates the economic impact of vision loss in Australia in 2009. It updates a previous report commissioned by the Centre for Eye Research Australia (CERA) to conduct a study on the cost of vision loss in Australia in 2004. 'Clear Insight: the economic impact and cost of vision loss in Australia' (Centre for Eye Research Australia and Access Economics, 2004) provided estimates of the prevalence, direct health system costs, and indirect costs and loss of wellbeing from vision loss resulting from:

- Cataract;
- Glaucoma;
- Diabetic retinopathy (DR);
- Age-related macular degeneration (AMD); and
- Refractive error (RE).

It was estimated that the financial costs of vision loss summed to over $5.0 billion in 2004, and the net cost of human suffering and premature death from low vision and blindness was estimated to be a further $4.8 billion. The total cost of vision loss was estimated to be $9.85 billion in 2004.

In 2005, Access Economics released a companion report for CERA which developed, in consultation with key stakeholders, a costed platform of strategic policy interventions to eradicate preventable blindness and vision loss through early detection, prevention, rehabilitation, education and research. In *Investing in Sight: Strategic Interventions to Prevent Vision Loss in Australia* (Access Economics 2005), it was estimated that the total cost of the package in 2005-06 would be $188.8 million. In turn, it was estimated that such a package would deliver net financial savings of $650 million in present value terms over the lifetime of the populations impacted by the interventions — a return of close to $5 for every dollar invested. Quality of life gains were estimated at over 4,500 DALYs averted in the first year (worth over $700 million and accumulating to $7.7 billion over the lifetime of the populations). This equated to a saving of some 11% of the loss of wellbeing from vision loss and blindness nationally.

These reports had very important implications, in particular the finding that vision loss imposed a substantial economic cost in 2004, and the need for promotion of eye health through education and awareness, as well as rehabilitation and research.

The release of updated data on health system expenditures, population estimates, mortality, labour force and loss of wellbeing has prompted the need for updated estimates for the cost of vision loss in Australia.

2 Prevalence rates and projections

This chapter presents 2009 prevalence estimates of vision loss and blindness from various eye conditions and prevalence projections to 2020. Specific eye conditions for which 2009 prevalence was separately identified include:

- Cataract;
- Glaucoma;
- Diabetic retinopathy (DR);
- Age-related macular degeneration (AMD); and
- Refractive error (RE) – hyperopia, myopia, astigmatism and presbyopia.

Two comprehensive and internationally renowned studies of the prevalence of vision loss have been conducted in Australia — the Melbourne Visual Impairment Project (MVIP) and the Blue Mountains Eye Study (BMES). These studies provided high quality data on the distribution and impact of vision loss in Australia and are still widely used.

The MVIP was the first large population based assessment of vision loss and eye disease in Australia. The study recruited and performed eye tests on 3,271 participants aged 40 years and older from Melbourne, Victoria. The initial baseline study was conducted during the period 1992 to 1994, followed by a five-year incidence study during 1997 to 1999. The MVIP also included representative rural (1,473) and nursing home (403) samples.

The BMES was another population-based study of vision loss in an older community sample of 3,654 residents who were examined during the period 1992 to 1994. A five-year follow-up examination was conducted during 1997 to 1998, with ten-year follow-ups completed in early 2004.

Centre for Eye Research Australia and Access Economics (2004) presented estimates of age-specific prevalence rates for vision loss and blindness extrapolated by combining MVIP and BMES data-sets. Since the MVIP and BMES are still the most comprehensive and representative studies on vision loss in Australia, the age-specific prevalence rates from Centre for Eye Research Australia and Access Economics (2004) were again used in this report, applied to the latest population estimates and projections from Access Economics Demographic Model (AE-Dem).

Refined rates for the prevalence of glaucoma for this report were drawn from Centre for Eye Research Australia and Access Economics (2008) as discussed in Section 2.3.1. In addition, the age-specific prevalence profile for DR was adjusted to account for increased prevalence of diabetes mellitus since 2004-05. This adjustment is detailed in Section 2.4.

2.1 Definitions - vision loss and blindness

Vision loss can broadly be defined as a limitation in one or more functions of the eye or vision system. This most commonly involves impairment of visual acuity (sharpness or clarity of vision), visual field (the ability to detect objects to either side, above or below the direction of

sight), and/or colour vision. Defective colour vision, a genetic inability or reduced ability to distinguish differences in hue, is not a subject of this report.

Unimpaired vision is recorded as 6/6 (20/20 in imperial measures). The first number is the distance at which a person is seated from the test chart. The second number is the distance at which the normal eye can see a letter on a test chart. A figure of 6/12, for example, would indicate that an individual can clearly see at a distance of six metres what a person with unimpaired vision could see at a distance of twelve metres.

Visual field is measured in terms of degrees from the point of fixation. For example, $<10^{o}$ field means that the person can only see in a visual field of less than ten degrees radius from the point of fixation.

In Australia, legal blindness is defined as distance vision acuity of <6/60 in the better eye with correction (ie, through use of glasses or contact lenses) or a visual field of less than 10^{o}, or both. This definition was primarily created for purposes of determining welfare and special services access. Total blindness refers to people who are unable to see light.

This report defines vision loss as being less than driving vision, which is measured as 6/12. Blindness prevalence and projections are estimated by using the definition of legal blindness (<6/60 or visual field of less than 10^{o}, or both).

2.2 Cataract

A cataract is a cloudy area in the eye's lens. The lens is made mostly of water and protein, with the protein arranged to let light pass through and focus on the retina. Some of the protein may clump together and cloud a small area of the lens. Over time, the cataract may grow larger and cloud more of the lens, making it hard to see.

The most common symptoms of cataract are cloudy or blurry vision; problems with light – headlights that seem too bright, glare from lamps or the sun, or a halo or haze around lights; colours that seem faded; double or multiple vision (this symptom goes away as the cataract grows); and /or frequent changes required in eyeglasses or contact lenses.

There are four main types of cataract:

- **Age-related cataract**: Most cataracts are related to ageing.
- **Congenital cataract**: Some babies are born with cataracts or develop them in childhood, often in both eyes.
- **Secondary cataract**: Cataracts may be linked to certain other health issues, such as diabetes or steroid use.
- **Traumatic cataract**: Cataracts can develop soon after an eye injury, or years later.

It is still unclear what causes cataract, however age, smoking, diabetes, use of cortico-steroids and ultraviolet exposure increase the risk. Detection is through an eye examination including a visual acuity test (eye chart test), pupil dilation (where the pupil is widened with eye-drops to allow the eye care professional to see more of the lens and look for other eye problems).

For an early cataract, different spectacles, magnifying lenses, or stronger lighting may improve vision. At a certain point, based on visual acuity and patient concern, surgery may be needed to improve vision.

2.2.1 Prevalence of vision loss from cataract

Prevalence rates for vision loss and blindness from cataract from combined MVIP/BMES data are presented in Table 2.1. For those aged less than 50, cataracts are a relatively rare cause of vision loss. For older people, prevalence increases from approximately 0.1% in the 60-69 year age group to 15.2% in the population aged over 90.

Table 2.1: Prevalence rates for vision loss and blindness from cataract

Age group	Vision loss(a)	Blindness
40-49	-	-
50-59	0.04%	-
60-69	0.09%	-
70-79	1.42%	0.05%
80-89	6.63%	0.75%
90+	15.17%	1.51%

(a) Including blindness.
Source: Centre for Eye Research Australia and Access Economics (2004) from MVIP and BMES study data-sets

Applying these prevalence rates to the 2009 population suggests approximately 84,960 people had vision loss from cataract in 2009. Of these, 7,700 were blind because of cataract. By 2020, nearly 126,400 people are projected to have cataract-related vision loss — and 11,350 are projected to have cataract-related blindness in 2020 (Table 2.2 and Table 2.3).

Table 2.2: Vision loss from cataract - number of people(a)

Age group	2009	2011	2014	2017	2020
40-49	-	-	-	-	-
50-59	1,180	1,225	1,291	1,322	1,354
60-69	1,735	1,874	2,056	2,179	2,294
70-79	17,540	18,355	20,405	23,541	26,824
80-89	45,844	48,074	50,152	53,138	57,531
90+	18,660	22,446	27,998	33,447	38,371
Total	**84,959**	**91,974**	**101,902**	**113,629**	**126,373**

(a) Including blindness.
Source: Access Economics derived from combined MVIP and BMES data; AE-Dem population projections

Table 2.3: Blindness from cataract - number of people

Age group	2009	2011	2014	2017	2020
50-59	-	-	-	-	-
60-69	-	-	-	-	-
70-79	654	685	761	878	1,001
80-89	5,195	5,448	5,683	6,022	6,520
90+	1,862	2,240	2,794	3,338	3,829
Total	**7,712**	**8,373**	**9,239**	**10,238**	**11,349**

Source: Access Economics derived from combined MVIP and BMES data; AE-Dem population projections

2.3 Glaucoma

Glaucoma is a group of diseases that can lead to damage to the eye's optic nerve and result in blindness. It has no symptoms at first, but can gradually steal a person's sight. With early treatment, eyes may be protected against serious vision loss and blindness.

The optic nerve comprises over a million nerve fibres connecting the retina with the brain. In the front of the eye is a space called the *anterior chamber* – clear fluid flows in and out of this space, leaving the chamber at the angle where the cornea and iris meet. When the fluid reaches the angle, it flows through a spongy meshwork, like a drain, and leaves the eye.

Open-angle glaucoma, the most common type, occurs when, for unknown reasons, the fluid passes too slowly through the meshwork drain. As the fluid builds up, the pressure inside the eye rises. Unless the pressure at the front of the eye is controlled, it can damage the optic nerve and cause vision loss. At first, vision is normal and there is no pain. If glaucoma remains untreated, people notice that although they see things clearly in front of them, they miss objects to the side and out of the corner of their eye. Without treatment, they may find that they suddenly have no side vision. It may seem as though they are looking through a tunnel. Over time, the remaining forward vision may decrease until there is no vision left.

Increased risk for glaucoma occurs with glaucoma elevated intraocular pressure, older age, large cup to disc ratio, thin central cornea, family history and ethnicity (particularly people from African-American decent). A family history of glaucoma increases risk of glaucoma eight times and some glaucoma genes have been identified. Other suspected but not confirmed risk factors include high refractive error, diabetes, sleep apnoea, male, cataract, migraine, optic disc haemorrhage and peripheral vasospasm (Centre for Eye Research Australia and Access Economics 2008).

More than 50% of individuals with glaucoma in the developed world are unaware they have the disease (Quigley, 1996). Based on MVIP data, Wensor et al (1998) found that 50% of those with definite primary open angle glaucoma had not been diagnosed previously, and Wong et al (2004) examined MVIP data and found that 59% of definite cases of open angle glaucoma were undiagnosed in people who had visited an eye care provider in the previous year.

Glaucoma is detected through an eye examination including visual acuity, visual field, tonometry and optic nerve examination. Although there is no cure for glaucoma, early diagnosis and treatment are important to control it and thus protect sight.

2.3.1 Prevalence of vision loss from glaucoma

Prevalence rates for this report were drawn from Centre for Eye Research Australia and Access Economics (2008). While these are for primary open angle glaucoma, this is the most common form of the disease. These rates are preferable as they have been refined to account for small sample sizes of those with glaucoma in the MVIP and BMES.

Glaucoma-related vision loss is strongly age-related (Table 2.4).

Table 2.4: Prevalence rates for vision loss and blindness from glaucoma

Age group	Vision loss(a)	Blindness
40-49	-	-
50-59	-	-
60-69	0.1%	0.1%
70-79	0.5%	0.1%
80-89	1.5%	0.3%
90+	6.1%	4.3%

(a) Including blindness.
Source: Centre for Eye Research Australia and Access Economics (2008) from MVIP and BMES

These prevalence rates were applied to the latest population numbers to obtain an estimate of approximately 27,000 persons with vision loss from glaucoma in 2009. Of these, 10,500 were blind. In 2020, the projected number of people with vision loss from glaucoma is 41,900, 18,000 of whom would be blind (Table 2.5 and Table 2.6).

Table 2.5: Vision loss from glaucoma - number of people(a)

Age group	2009	2011	2014	2017	2020
40-49	-	-	-	-	-
50-59	-	-	-	-	-
60-69	3,030	3,273	3,591	3,806	4,005
70-79	6,449	6,749	7,503	8,656	9,863
80-89	10,117	10,609	11,067	11,726	12,696
90+	7,472	8,988	11,211	13,393	15,365
Total	**27,068**	**29,619**	**33,372**	**37,581**	**41,929**

(a) Including blindness.
Source: Access Economics from MVIP and BMES study data-sets and AE-Dem population estimates

Table 2.6: Blindness from glaucoma - number of people

Age group	2009	2011	2014	2017	2020
50-59	-	-	-	-	-
60-69	1,559	1,684	1,847	1,958	2,060
70-79	1,818	1,903	2,115	2,440	2,781
80-89	1,933	2,027	2,115	2,241	2,426
90+	5,236	6,298	7,856	9,384	10,766
Total	**10,545**	**11,911**	**13,933**	**16,023**	**18,033**

Source: Access Economics from MVIP and BMES study data-sets and AE-Dem population estimates

2.4 Diabetic retinopathy

All people with diabetes mellitus (DM) – both type 1 and type 2 – are at risk of developing DR and should have a comprehensive dilated eye exam at the time of diagnosis and at least once every two years thereafter — once every year for Indigenous people — if no DR is found (NHMRC 2008). If DR is detected, further examinations should be conducted annually or at three-12 monthly intervals depending on the level of DR. Any visual symptoms should prompt a further referral (NHMRC 2008). During pregnancy, DR may be a problem for women with diabetes, who should have an early eye exam and ongoing monitoring. Early diagnosis and treatment can prevent up to 98% of severe vision loss. Lack of awareness and communication breakdowns are major impediments to regular screening.

DR is an important cause of vision loss. It occurs when DM damages the tiny blood vessels inside the retina, and usually affects both eyes. At first, microaneurysms occur. As the disease progresses, some blood vessels that nourish the retina are blocked. There are two ways that vision loss occurs:

- **proliferative retinopathy**: if many blood vessels are blocked, and several areas of the retina are deprived of their blood supply, signals are sent to grow new blood vessels, which may be abnormal and fragile, growing along the retina and along the surface of the clear, vitreous gel that fills the inside of the eye. These blood vessels have thin, fragile walls that, if they leak blood into the centre of the eye, can result in blurred vision and blindness.
- **macular oedema***:* fluid can leak into the macula, causing swelling and blurred vision. This is more likely to occur as the disease progresses. About half of people with proliferative retinopathy also have macular oedema.

DR often has no early symptoms. If bleeding occurs, the person can see specks of blood, or spots, "floating" in their vision. Occasionally spots clear without treatment, but haemorrhages tend to happen more than once, often during sleep. The earlier treatment is received, the more likely it is to be effective. Control of blood sugar, cholesterol and blood pressure, as well as the length of time a person has had diabetes are related to the risk and severity of DR.

2.4.1 Prevalence of vision loss from DR

The prevalence of DR is of course highly dependent on the prevalence of DM. DM is a leading cause of mortality and morbidity in Australia. Between 25% and 44% of people with diabetes have some form of DR at any point in time (NHMRC 2008). Taylor (2001) estimated that only

half the Australians with diabetes had regular eye exams and one third had never been checked.

Of the diabetes prevalence studies conducted in Australia, the Australian Diabetes, Obesity and Lifestyle study (AusDiab 2001) was the most comprehensive as it estimated both diagnosed and undiagnosed DM, based on a diagnostic blood test. The AusDiab study still represents the most recent source on *total* diabetes prevalence (diagnosed and undiagnosed). Based on AusDiab prevalence rates and AE-Dem population figures, there were an estimated 1.1 million Australians aged over 40 with DM (diagnosed and undiagnosed) in 2009. By 2020, this is estimated to rise to 1.5 million Australians.

The advantage of the Australian Bureau of Statistics (ABS) National Health Survey (NHS) is that it is conducted periodically, and therefore allows us to see increases in DM prevalence over time. However, a limitation is that it estimates diagnosed DM prevalence, based on self-reported information. The recent NHS (ABS 2009) reported an estimated 818,200 persons (3.8% of the Australian population) with *diagnosed* DM in 2007-08. This represented an increase in the proportion reported in the 2004-05 NHS (3.4%).

To account for the increase in diagnosed diabetes prevalence reported by the NHS between 2004-05 and 2007-08, DR prevalence rates from the MVIP/BMES data were adjusted upwards. The age-specific increases in DM prevalence for those aged over 35 were used to develop weightings which were then applied to age-specific DR prevalence rates. The adjusted prevalence rates for vision loss from DR are presented in Table 2.7.

Australian data from the MVIP and BMES show a very small proportion with vision-threatening DR. This is in stark contrast with US data (Kempen et al 2004) that estimates that 0.75% of the population over 40 (ie, nearly one quarter of Americans with DR) have vision-threatening DR. The sample data were also inadequate to determine the proportion of those with vision-impairing DR who are blind.

Table 2.7: Prevalence rates for vision loss from DR

Age group	Vision loss	Blindness(a)
40-49	-	na
50-59	0.05%	na
60-69	0.18%	na
70-79	0.06%	na
80-89	0.51%	na
90+	0.59%	na

Na = not available. (a) The sample data were inadequate to determine the proportion of those with vision-impairing DR who are blind.

Source: Access Economics from MVIP and BMES study data-sets and NHS 2004-05 and 2007-08 (ABS, 2009, 2006)

These prevalence rates were applied to the latest population numbers to obtain an estimate of approximately 10,000 persons with vision loss from DR in 2009. Prevalence rates were applied to population projections to estimate 13,440 people with DR-related vision loss in 2020 (Table 2.8).

Table 2.8: Vision loss from DR - number of people

Age group	2009	2011	2014	2017	2020
40-49	-	-	-	-	-
50-59	1,421	1,475	1,555	1,593	1,631
60-69	3,635	3,926	4,308	4,565	4,805
70-79	732	766	852	983	1,120
80-89	3,506	3,676	3,835	4,064	4,399
90+	722	869	1,083	1,294	1,485
Total	**10,016**	**10,713**	**11,633**	**12,499**	**13,440**

Source: Access Economics from MVIP and BMES study data-sets and AE-Dem population estimates.

2.5 Age-related macular degeneration

AMD is an eye disease that usually develops after 50 years of age, progressively destroying the macula, the central portion of the retina and impairing central vision. Changes to the central area of the macula responsible for detailed vision can be rapid, impacting severely on day to day life. AMD can be classified as 'early AMD' (less severe) or 'late AMD' (varying severity). Clinicians distinguish between two forms of late AMD: wet and dry form.

In the early stages of AMD, pale yellow spots caused by distinct lesions consisting of lipids and protein (known as drusen) accumulate as deposits within Bruch's membrane[3] and beneath the retinal pigment epithelium (RPE). The progression of early AMD to late AMD, usually to dry AMD (geographic atrophic) and then to wet AMD (exudative or neovascular) is generally associated with a decrease in visual acuity.

Geographic atrophic (GA) AMD is characterised by light-sensitive cells in the macula slowly breaking down (located directly under the RPE) and being replaced with scar tissue. People with GA AMD have extensive medium-sized drusen or one or more large drusen in one or both eyes. At this stage, people with GA AMD will have substantially decreased capacity for near visual tasks as central vision deteriorates. Severe central vision loss can occur once a person develops GA AMD.

In the wet form of AMD, exudative or neovascular AMD is caused by blood vessels reproducing in the choroid in a process called choroidal neovascularisation (CNV). The new choroidal vessels leak or bleed into the underlying retina, damaging the retina, including the central macula region. The blood and fluid can also cause macular scarring or the detachment of either the retinal pigment epithelium or sensory retina.

In all types, wet AMD is characterised by the appearance of central visual blurring and distortion, with straight lines appearing crooked or wavy. It can occur in one eye without any symptoms being recognised by the person, although symptoms become more noticeable once the second eye is affected.

Progression of AMD will usually occur less rapidly if lifestyle risk factors are addressed. Epidemiological studies have identified several risk factors that can increase the risk of

[3] Bruch's membrane is the innermost layer of the choroid. The choroid is the layer between the white of the eye (sclera) and the inner surface of the eye (retina).

developing AMD and increase the speed at which the disease progresses. Cigarette smoking is the main lifestyle risk factor for AMD, although alcohol consumption and obesity have been shown to be associated with an increase in developing AMD. Control of these modifiable risk factors could reduce the risk of developing AMD by half (45%) (Tomany et al 2004).

Progression of AMD will also occur more steadily if protective measures are taken. Nutrition, or more specifically dietary antioxidants, plays an important role in the occurrence, prevention and treatment of AMD. Recent research suggests that some foods such spinach, egg yolks, seafood (especially oysters), seeds, nuts, whole grains and fatty fish may decrease a person's risk for the disease by up to 65% (Tan et al, 2008). Since there is currently no effective treatment for GA AMD, prevention is the first approach to reducing vision loss.

For neovascular AMD, substantial progress has been made in the development of new and effective treatments. Ranibizumab (Lucentis), an anti-vascular endothelial growth factor (VEGF) agent, is a new therapy that can slow the progression of neovascular AMD and in some cases restore some vision to the individual. Just before the Pharmaceutical Benefits Schedule (PBS) listing of Lucentis in August 2007, the Department of Health and Ageing (DoHA 2007) expected that around 11,500 new patients would commence treatment in the 2007-08 financial year, rising to around 15,000 patients by 2012-13.

PBS data (Medicare 2010) indicate that the volume (services) of Medicare processed claims was 72,782 in the 2008-09 financial year. Lucentis is administered monthly, with the option to reduce treatment to one injection every three months, after the first three monthly injections (Novartis 2010). Dividing the number of PBS claims in 2008-09 (72,782) by this inferred minimum of six doses per year gives an estimate of approximately 12,130 patients lodging PBS claims in 2008-09. This is approximately 20% of the estimated 2009 prevalence of total AMD in this report.

2.5.1 Prevalence of vision loss from AMD

The prevalence rates for vision loss and blindness from AMD are presented in Table 2.9.

Table 2.9: Prevalence rates for vision loss and blindness from AMD

Age group	Vision loss(a)	Blindness
40-49	-	-
50-59	0.05%	-
60-69	0.04%	-
70-79	0.85%	0.28%
80-89	4.60%	2.37%
90+	12.97%	10.68%

(a) Including blindness.
Source: Centre for Eye Research Australia and Access Economics (2004) from MVIP and BMES study data-sets

Approximately 60,350 people had vision loss from AMD in 2009. Of these, almost 33,000 were blind from AMD. By 2020, the number with vision loss from AMD is projected to be 91,300 of whom close to 53,000 would be blind (Table 2.10 and Table 2.11).

Table 2.10: Vision loss from AMD - number of people(a)

Age group	2009	2011	2014	2017	2020
40-49	-	-	-	-	-
50-59	1,336	1,387	1,462	1,498	1,533
60-69	811	877	962	1,019	1,073
70-79	10,449	10,935	12,157	14,025	15,980
80-89	31,789	33,336	34,776	36,848	39,893
90+	15,959	19,197	23,946	28,606	32,817
Total	**60,346**	**65,732**	**73,303**	**81,996**	**91,297**

(a) Including blindness.
Source: Access Economics from MVIP and BMES study data-sets and AE-Dem population estimates

Table 2.11: Blindness from AMD - number of people

Age group	2009	2011	2014	2017	2020
50-59	-	-	-	-	-
60-69	-	-	-	-	-
70-79	-	-	-	-	-
80-89	3,493	3,655	4,063	4,688	5,341
90+	16,359	17,155	17,896	18,962	20,529
Total	**32,992**	**36,616**	**41,676**	**47,203**	**52,891**

Source: Access Economics from MVIP and BMES study data-sets and AE-Dem population estimates

2.6 Refractive error

More than half of vision loss is caused by refractive error, which means that the image of the object a person is looking at is not focussed properly onto the retina (the light-sensitive tissue in the back of the eye). Symptoms include blurred vision, eye strain, tiredness, reduced concentration and headaches, as the eyes try without success to correct the blur and because there is a tendency to squint the eyes to try to see better, producing muscle discomfort in the eyelid and face. There are four main types of refractive errors, which can affect people at any age, diagnosed through a simple vision test, and managed through wearing glasses, contact lenses (hard or soft) or laser refractive surgery.

- **Myopia** – short-sightedness; the light focuses in front of the retina so distant images are blurred. Myopia is caused either by excessively steep curvature of the cornea (the front surface of the eye) or excessive axial length of the eye, or both. There is some genetic influence and some evidence for environmental influence, such as excessive amounts of near work. Spectacles or contact lenses (concave) enable clear vision by diverging incoming light rays, so they are properly focussed on the retina.
- **Hyperopia** – long-sightedness; the light focuses behind the retina so close images are blurred. The average person is a little hyperopic, however significant hyperopia cannot be accommodated and is thought to be genetic (the eyeball may be a little smaller than average). Retinoscopy and refraction tests are required for diagnosis, with correction through a convex lens, which converges the light rays.

- **Astigmatism** – is focusing error that causes asymmetric blur at all distances, mostly caused by the shape of the cornea or by slight tilting of the lens – either inherited or a normal variation accompanying growth. Non-spherical curvatures result in light focusing at two different locations, rather than to a point. Most people have at least very slight astigmatism, again correctable through wearing spectacles and lenses. Sometimes correction of astigmatism can cause change in the apparent size and shape of objects and may affect judgement of distance. A person may feel taller or shorter, or walls may appear to slope and floors curve. In most cases, adjustment to these side effects takes only a week or so. However, astigmatism correction may involve a compromise between optimal clarity and visual discomfort.
- **Presbyopia** – is age-related vision difficulty at normal reading distance. In youth, to focus on close objects, a muscle in the eye changes the shape of the lens, called *accommodation*. With ageing, the lens loses its flexibility and is less able to change shape. Although, like stiffening joints or greying hair, presbyopia cannot be prevented, it can be corrected by spectacles or lenses, such as bifocal prescriptions, with distant vision in the top half of the lens and near vision in the lower half. Other options include `look-overs' or half-glasses, trifocals, progressive lenses and some special contact lenses. Presbyopia is usually first noticed around the age of 40-45 years (although in reality the process has been occurring since childhood) and continues changing vision to about age 65; from 65 onwards, there are unlikely to be any further significant progression of presbyopia. Between the ages of 45 and 65, reading glasses may need to be changed every two to three years for optimal correction.

2.6.1 Prevalence of vision loss from uncorrected refractive error

Uncorrected refractive error occurs when a person's vision is reduced because they either need glasses and do not have them, or their current glasses need to be changed to give them their clearest vision. The prevalence rates for vision loss and blindness from uncorrected refractive error are presented in Table 2.1. These rates exclude presbyopia, but are the same as those used in Centre for Eye Research Australia and Access Economics 2004. Estimates for presbyopia are presented separately in Section 2.6.2.

Table 2.12: Prevalence rates for vision loss and blindness from uncorrected refractive error(a)

Age group	Vision loss(b)	Blindness
40-49	0.48%	-
50-59	1.84%	-
60-69	3.92%	0.04%
70-79	7.81%	0.01%
80-89	13.01%	0.18%
90+	7.86%	-

(a) Excluding presbyopia. (b) Including blindness.
Source: Centre for Eye Research Australia and Access Economics (2004) from MVIP and BMES study data-sets

These prevalence rates were applied to the latest population numbers to obtain an estimate of approximately 341,200 persons with vision loss from uncorrected refractive error in 2009, with almost 2,200 being blind from uncorrected refractive error. The number of vision impaired

people with refractive error is expected to rise to 459,900 in 2020, with 2,800 of these being blind (Table 2.13 and Table 2.14).

Table 2.13: Vision loss from uncorrected refractive error - number of people(a)(b)

Age group	2009	2011	2014	2017	2020
40-49	14,728	15,081	15,443	15,768	16,061
50-59	50,607	52,539	55,376	56,725	58,077
60-69	79,864	86,275	94,653	100,315	105,576
70-79	96,414	100,894	112,165	129,405	147,447
80-89	89,937	94,312	98,388	104,247	112,864
90+	9,670	11,632	14,509	17,333	19,885
Total	**341,219**	**360,732**	**390,534**	**423,793**	**459,909**

(a) Excluding presbyopia. (b) Including blindness.
Source: Access Economics from MVIP and BMES study data-sets and AE-Dem population estimates

Table 2.14: Blindness from uncorrected refractive error - number of people

Age group	2009	2011	2014	2017	2020
50-59	-	-	-	-	-
60-69	811	877	962	1,019	1,073
70-79	83	87	96	111	126
80-89	1,277	1,339	1,397	1,480	1,603
90+	-	-	-	-	-
Total	**2,171**	**2,302**	**2,455**	**2,611**	**2,802**

Source: Access Economics from MVIP and BMES study data-sets and AE-Dem population estimates

2.6.2 Prevalence of presbyopia

Presbyopia is not included in the World Health Organisation's reported prevalence of uncorrected refractive error (Holden et al 2008) and is not included in overall prevalence of vision loss in this report (Section 2.7). Nevertheless, estimates of the number of people affected have been added here because of the large expected impact given Australia's ageing population. Presbyopia is unlikely to result in indirect financial costs, but may affect wellbeing. The health system costs in this report are for diseases of the eye and adnexa (rather than vision loss *per se*) and thus include any direct costs associated with presbyopia.

Near vision can be assessed using an N notation chart, with presbyopia in those with normal distance vision being defined as binocular near vision worse than N8 reading size in subjects aged over 35, with visual acuity of 6/12 or better (Marmamula 2009). Taylor et al (1997) reported near-vision measurement estimates for the 40 and over age group from the MVIP sample, which enabled presbyopia prevalence to be derived. In the MVIP study, functional near vision was measured with a log MAR word reading card, designed for use at 25 centimetres, although the test was performed at the participant's preferred reading distance. Vision correction devices/spectacles were worn for testing, if the participant normally used them. Thus, prevalence estimates derived here represents uncorrected presbyopia (ie, those who either do not have vision correction aids for presbyopia and need them, or those whose current vision correction aids need to be changed to give them their clearest vision). Of the

total MVIP sample of 3,271 participants aged over 40, 3,261 participants had full near-vision testing performed.

Of the MVIP near-vision sample, 24 participants who had normal distance vision were identified with presbyopia, using the definition of worse than N8 near vision, and visual acuity of 6/12 or better. The derived prevalence rate was thus 0.74%. Age specific prevalence rates were not available. Application of the derived prevalence rate to the Australian population aged 40 and over in 2009 suggests approximately 73,000 people have presbyopia and normal distance vision. It is estimated that this will rise to almost 90,000 people aged over 40 by 2020 (Table 2.15).

Table 2.15: Presbyopia in those with normal distance vision - number of people(a)

Age group	2009	2011	2014	2017	2020
40 and over	73,060	76,435	81,263	85,589	89,997

(a) defined as worse than N8 near vision and >6/12 distance visual acuity.
Source: Access Economics from MVIP (Taylor et al, 1997) and AE-Dem population estimates

2.7 Overall prevalence of vision loss and projections

The prevalence rates for overall vision loss and blindness (from all causes excluding presbyopia) are presented in Table 2.16.

Table 2.16: Prevalence rates for overall vision loss and blindness(a)

Age group	Vision loss	Blindness
40-49	0.63%	-
50-59	2.33%	0.09%
60-69	4.75%	0.25%
70-79	11.41%	0.70%
80-89	28.68%	4.26%
90+	45.11%	17.14%

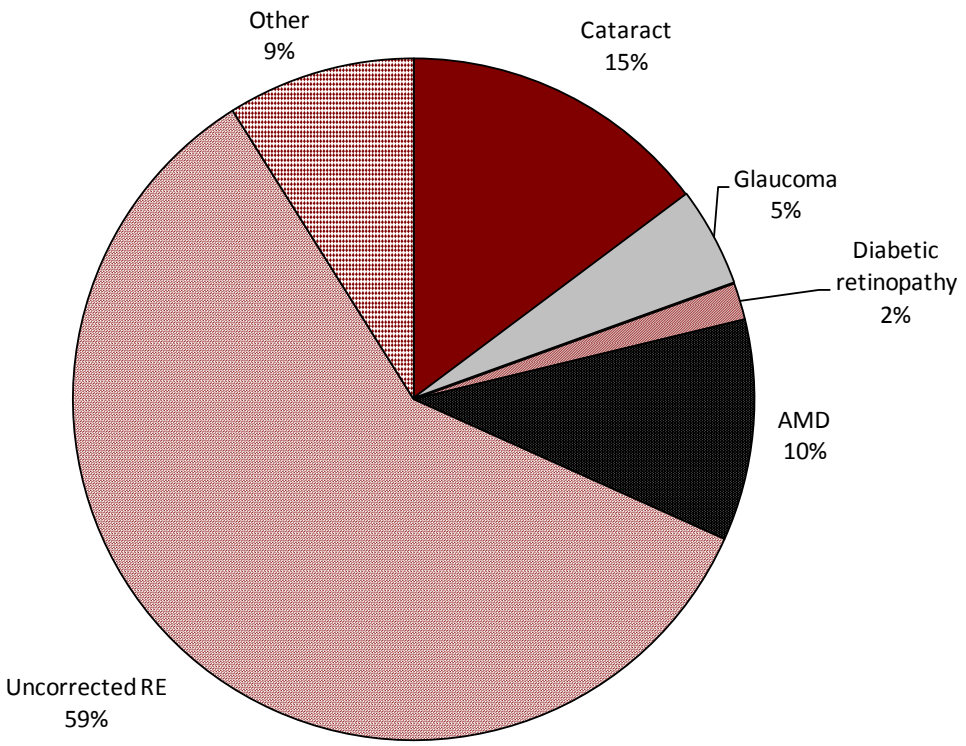
(a) Excluding presbyopia.

Source: Centre for Eye Research Australia and Access Economics (2004) from MVIP and BMES study data-sets

It is estimated that there were almost 575,000 Australians with vision loss in 2009, 5.8% of the Australian population over the age of 40 (Table 2.17). Around 66,500 people were blind, 0.67% of the Australian population aged over 40.

Most vision loss was caused by uncorrected refractive error (Chart 2.1). The 'Other' category includes other retinal causes, neuro-ophthalmic causes, corneal and other causes.

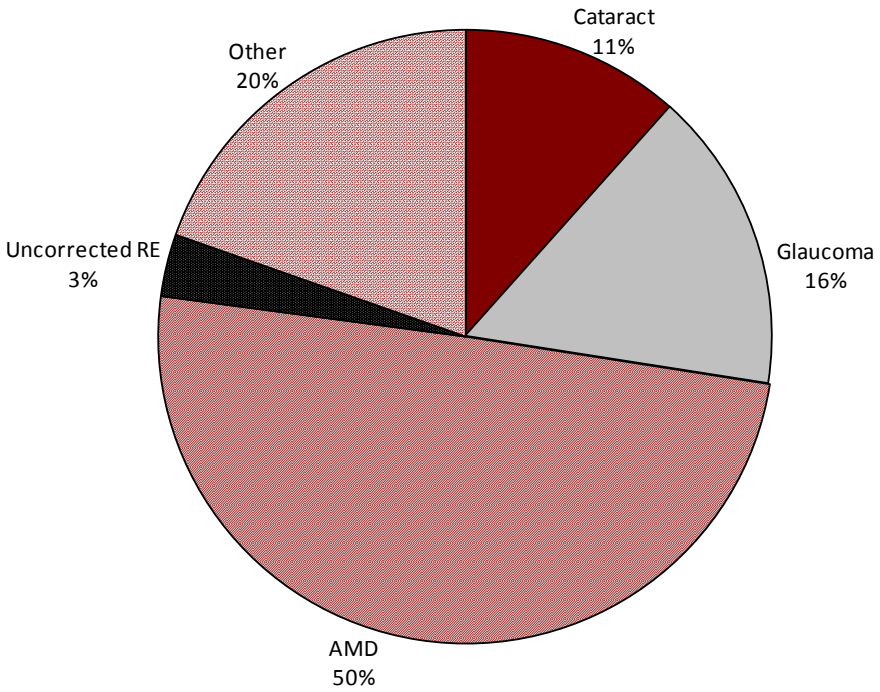
Chart 2.1: Vision loss by cause among Australians aged 40 or over, 2009(a)



(a) Excluding presbyopia.
Source: Access Economics

Half of blindness in 2009 could be attributed to AMD, with the next largest category being 'other' diseases (Chart 2.2). Glaucoma and cataract, respectively, were the third and fourth leading causes of estimated blindness. It should be noted that blindness from DR could not be estimated, due to limited data on prevalence.

Chart 2.2: Blindness by cause among Australians aged 40 or over, 2009



Source: Access Economics

It is projected that the number of persons with vision loss will rise to almost 801,000 by 2020 and those who are blind will rise to 102,750 (Table 2.17, Table 2.18). The number of persons with vision loss will steadily rise as a percentage of the over 40 Australian population, reaching approximately 6.6% by 2020. By 2020, the number of blind people will comprise approximately 0.84% of the over 40 Australian population. The projected rise in prevalence reflects demographic ageing, and assumes a policy-neutral environment.

The rise in the number of Australians aged 40 or over with vision loss is depicted in Chart 2.3.

Table 2.17: Overall vision loss - number of people(a)

Age group	2009	2011	2014	2017	2020
40-49	19,641	20,112	20,595	21,028	21,419
50-59	63,940	66,381	69,966	71,671	73,378
60-69	96,753	104,520	114,669	121,529	127,902
70-79	140,888	147,433	163,903	189,096	215,461
80-89	198,186	207,828	216,808	229,720	248,708
90+	55,488	66,744	83,256	99,459	114,100
Total	**574,895**	**613,018**	**669,198**	**732,504**	**800,969**
% of over 40s	**5.8%**	**5.9%**	**6.1%**	**6.3%**	**6.6%**

(a) Excluding presbyopia.

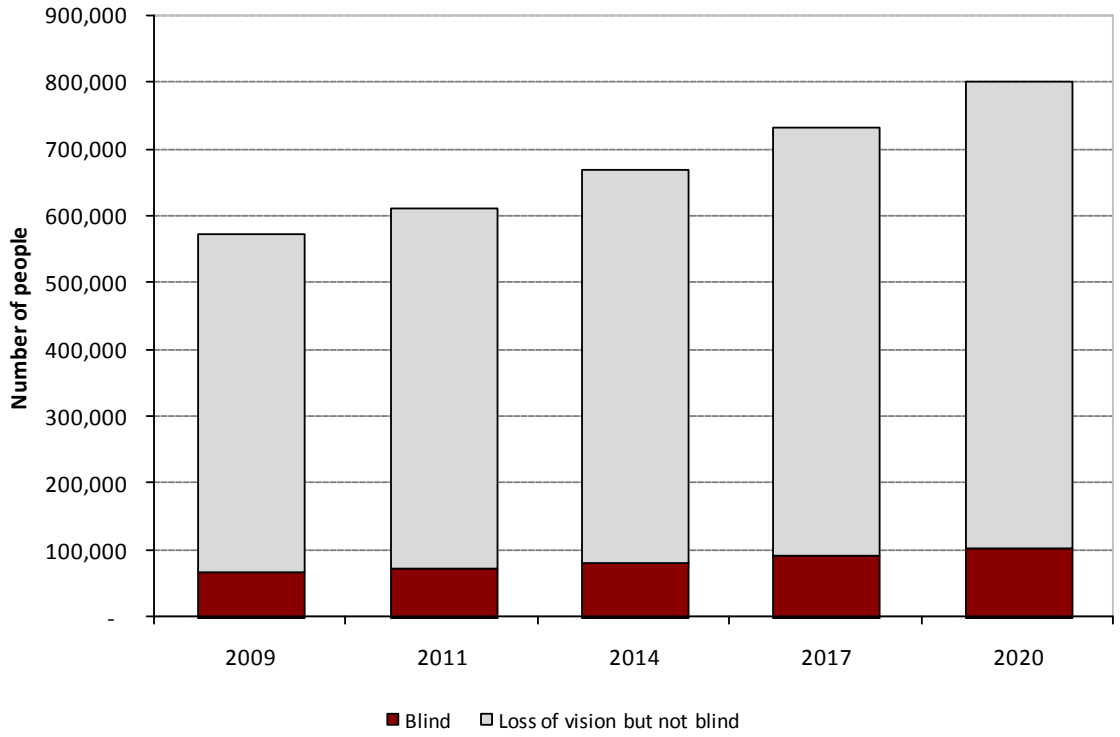
Source: Access Economics from MVIP and BMES study data-sets and AE-Dem population estimates

Table 2.18: Overall blindness - number of people

Age group	2009	2011	2014	2017	2020
50-59	2,343	2,432	2,564	2,626	2,689
60-69	5,029	5,432	5,960	6,316	6,648
70-79	8,586	8,985	9,989	11,524	13,131
80-89	29,422	30,854	32,187	34,104	36,923
90+	21,085	25,363	31,637	37,794	43,358
Total	**66,465**	**73,066**	**82,337**	**92,365**	**102,748**
% of over 40s	**0.67%**	**0.70%**	**0.75%**	**0.79%**	**0.84%**

Source: Access Economics from MVIP and BMES study data-sets and AE-Dem population estimates

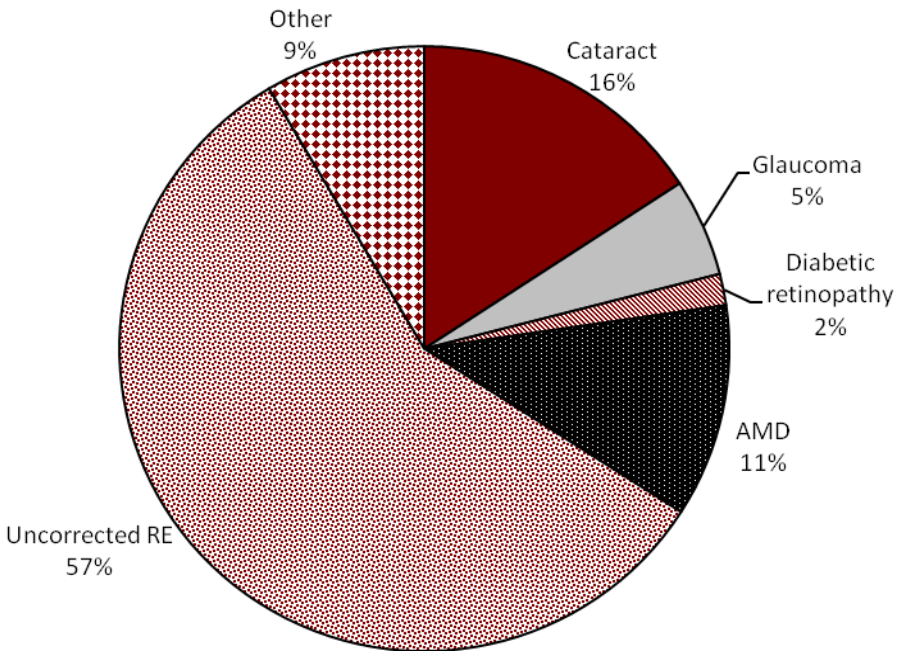
Chart 2.3: Projections of Australians (aged 40 or over) with vision loss



Source: Access Economics

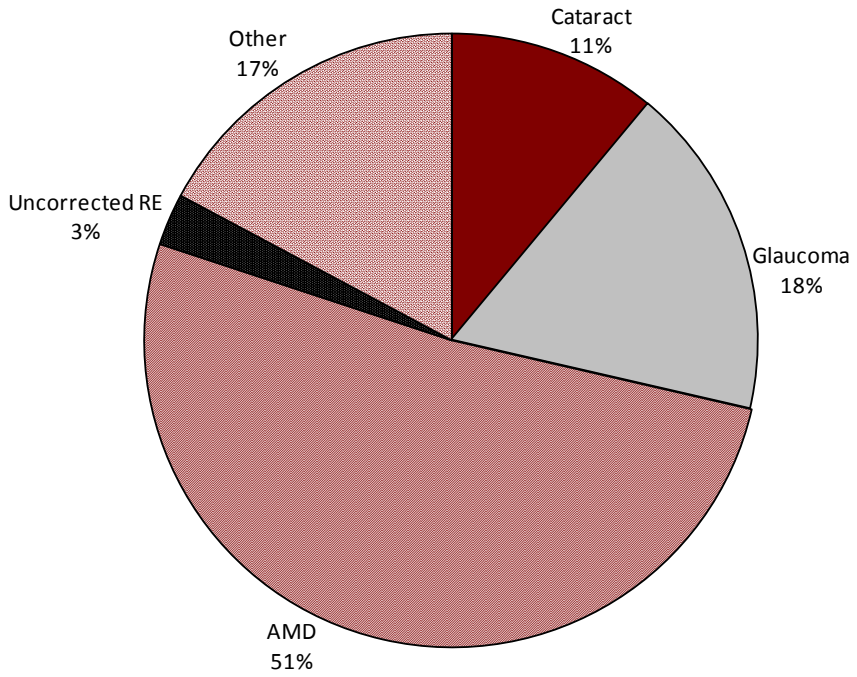
The breakup of estimated blindness and vision loss in 2020, by disease, is depicted in Chart 2.4 and Chart 2.5. The composition of vision loss by disease is estimated to change slightly, with uncorrected RE comprising a smaller proportion of vision loss than in 2009. AMD and cataract are projected to rise slightly, as a proportion of total vision loss. In 2020, it is estimated that approximately half of blindness will still be attributable to AMD. Glaucoma is estimated to increase its share of blindness by 2020, and the share from other diseases is expected to shrink slightly.

Chart 2.4: Vision loss by cause among Australians aged 40 or over, 2020(a)



(a) Excluding presbyopia.
Source: Access Economics

Chart 2.5: Blindness by cause among Australians aged 40 or over, 2020



Source: Access Economics

3 Mortality

Vision loss is associated with a higher than average risk of mortality (McCarty et al 2001; Wang et al 2001; Klein et al 1995). The vision loss itself does not directly cause death, but it is correlated with a higher risk of falls, motor vehicle accidents and depression (Centre for Eye Research Australia and Access Economics 2004).

The attributable fraction used in the previous report (Centre for Eye Research Australia and Access Economics 2004) was updated for this report to reflect more recent data. Mortality data (ABS 2010) for 'diseases of the eye and adnexa' as the underlying cause, and one of multiple causes of death for the years 2003 to 2008 were used to derive an attributable fraction for mortality from vision loss of 1.38%. Applying this to total calculated 2009 vision loss deaths produced an estimate of 1,111 deaths attributable to vision loss in 2009 (Table 3.19).

Table 3.19: Deaths associated with vision loss, 2009

Age group	Deaths in the vision loss population	Deaths attributable to vision loss
40-49	121	2
50-59	1,186	16
60-69	3,019	42
70-79	12,340	170
80-89	51,323	709
90+	12,456	172
Total	**80,446**	**1,111**

Source: Access Economics using ABS 3303.0 (2010) mortality data, AE-Dem population 2009 estimates and MVIP mortality rates

4 Health system costs

4.1 Description

This chapter estimates the direct health system costs of vision loss in Australia, disaggregated by cost components for the year 2009.

Direct financial costs to the Australian health system comprise the costs of running hospitals and nursing homes (buildings, care, consumables), general practitioner (GP) and specialist services funded through Medicare and patient contributions, the cost of prescribed and over-the-counter pharmaceuticals (Pharmaceutical Benefits Scheme and private), optometry and allied health services, research and 'other' direct costs (such as health administration).

4.2 Methodology

In this report, top-down estimates of health system expenditure for 2004-05 from the Australian Institute of Health and Welfare (AIHW), obtained by special request, were used. It should be noted that while the prevalence data related to *vision loss* specifically, the cost data refer to *disorders of the eye and adnexa*.

AIHW 2004-05 data were converted to 2009 prices using historical health cost inflation (AIHW 2009):

- 4.0% per annum for 2004-05 to 2005-06;
- 3.3% per annum for 2005-06 to 2006-07; and
- 2.9% per annum for years thereafter.

Additionally, adjustments were made for age-gender demographic changes and population growth between 2004-05 and 2008-09. The following spending categories were not included in the AIHW estimates for 2004-05:

- Outpatients in hospitals;
- Over-the-counter pharmaceuticals;
- Other health professionals; and
- Aged care homes.

Estimates for these categories from Centre for Eye Research Australia and Access Economics (2004) were therefore inflated to 2009 dollars, and adjusted for demographic change.

The AIHW changed the methodology for allocating health expenditure by disease between 2000-01 and 2004-05.[4] The AIHW (2010) provided the following break-down for unallocated health system expenditures in 2004-05 (comprising a total of 30%):

[4] For the older 2000-01 data from Clear Insight, 88% of total recurrent health system expenditure was included with excluded categories comprising capital expenditures, expenditure on community health, public health programs, health administration and health aids and appliances. The recent 2004-05 AIHW data allocated 70% of total recurrent health system expenditure to disease and injury groups. As noted by the AIHW (2010), this lower proportion was due to unallocated expenditures comprising capital expenditure and capital consumption, as well as

- 9.2% for non-admitted patient expenditure;
- 4.0% for over-the-counter pharmaceuticals;
- 3.4% for other health professionals;
- 1.9% for ambulance;
- 3.5% for aids and appliances;
- 4.8% for community and public health; and
- 3.2% for administration.

For this report, the first three categories were incorporated in the health expenditure estimates by inflating the estimates from Centre for Eye Research Australia and Access Economics (2004). The residual unallocated health system expenditure (13.4%) was incorporated by factoring up health expenditure estimates by 1/0.866.

Expenditure data were also supplemented to account for the cost of the recently-listed drug Lucentis for AMD, and for recent growth in rates of cataract surgery.

Pharmaceutical spending on Lucentis

Health system expenditures were adjusted to account for the 1 August 2007 listing of the drug, Lucentis (item 1382R), on the Pharmaceutical Benefits Scheme (PBS) for the treatment of wet, age-related macular degeneration (DoHA 2007).

A patient treated with Lucentis through the PBS is charged the standard co-payment of $33.30 for general patients and $5.40 for concessional patients. The dispensed price for maximum quantity is listed as $1,976.36 (DoHA, 2007).

PBS statistics indicate that total government expenditure on Lucentis was approximately $151 million in the 2008-09 financial year (Medicare, 2010). This estimate was allocated to age-gender groups according to the age-gender distribution of AIHW estimates of expenditure on pharmaceutical spending for AMD in 2004-05 (Table 4.20).

Table 4.20: Lucentis spending allocated by AMD pharmaceutical age-gender distribution

Age-gender group	Lucentis spending 2008-09	AMD pharmaceutical spending distribution(a)
Male		
0–4	2,677	-
5–14	168,855	0.11%
15–24	104,265	0.07%
25–34	111,069	0.07%
35–44	191,344	0.13%

expenditure on non-admitted patients, over-the-counter pharmaceuticals, patient transport (ambulance), other health practitioner services apart from optometrical services (out-of-hospital non-medical health services), health aids and appliances and health administration. In addition, the 2000–01 AIHW data used a different definition of health, which included high-level residential aged care (AIHW, 2010).

Age-gender group	Lucentis spending 2008-09	AMD pharmaceutical spending distribution(a)
45–54	412,007	0.27%
55–64	1,000,249	0.66%
65–74	10,060,854	6.66%
75+	48,344,349	32.00%
Female		
0–4	10,732	0.01%
5–14	100,363	0.07%
15–24	79,350	0.05%
25–34	250,631	0.17%
35–44	411,257	0.27%
45–54	1,062,463	0.70%
55–64	8,347,710	5.53%
65–74	14,681,789	9.72%
75+	65,730,951	43.51%
Total (all persons)	**151,070,916**	**100.00%**

(a) Derived from AIHW 2004-05 special request data for AMD
Source: Access Economics using 2008-09 PBS data (Medicare 2010) and AIHW special request 2004-05 data (2010)

Centre for Eye Research Australia and Access Economics (2004) noted, but did not include in their estimates, the cost of Visudyne therapy, a photodynamic therapy with verteporfin to treat AMD. It was noted that federal government spending on Visudyne was approximately $35.5 million in 2004-05.

Visudyne was largely replaced with the listing of Lucentis as the treatment option for the majority of patients; however it continues to be preferred therapy for some patients. The costs of Visudyne therapy were not added to the AIHW prescribed pharmaceutical spending estimates for this report, to be consistent with the Clear Insight report, and because Lucentis is now the primary treatment option.

Growth in cataract surgery

Since 2004-05, there has been substantial growth in cataract surgery volumes. Age-group growth rates in cataract surgeries between 2004-05 and 2007-08 were derived from AIHW National Hospital Morbidity data cubes and from special-request data on out-of-hospital cataract surgeries from Medicare (2010). Procedures counted were those included under codes 42698, 42701 and 42702 under the Australian Classification of Health Interventions (ACHI).

Derived growth rates were adjusted to reflect growth in excess of population growth within age groups (since population growth was applied to total health system expenditure on eye diseases). Since Medicare data did not cover cataract surgeries for public patients in public hospitals, the AIHW-derived growth rates were applied to AIHW data on admitted patient spending on cataracts. Growth rates derived from the Medicare data were applied to out-of-

hospital medical services for cataracts. The growth rates which were applied are presented in Table 4.21.

Table 4.21: Growth in cataract surgery 2004-05 to 2007-08 (in excess of population growth)

Age group	AIHW data cubes(a)	Medicare data(b)
0–4	-11.11%	0.00%
5–14	-7.50%	-23.53%
15–24	10.27%	10.57%
25–34	-6.67%	-1.40%
35–44	4.76%	3.13%
45–54	7.83%	4.61%
55–64	12.01%	15.08%
65–74	1.71%	3.58%
75-84	4.09%	6.22%
85+	3.62%	2.32%
Overall	**3.15%**	**8.04%**

(a) Applied to AIHW 2004-05 cataract data on admitted patients, inflated/adjusted for demographic growth to 2009.
(b) Applied to AIHW 2004-05 cataract data on out-of-hospital medical spending, inflated/adjusted for demographic growth to 2009.
Source: Access Economics' calculation using special request Medicare data (2010) and AIHW National Hospital Morbidity data cubes (2010)

4.3 Health system expenditure on disorders of the eye and adnexa in 2009

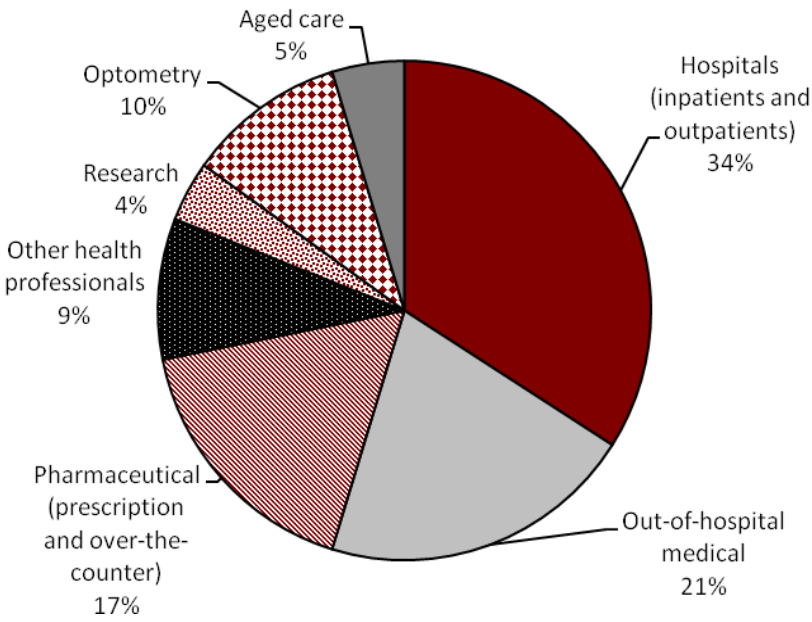
In 2009, total health system expenditure on disorders of the eye and adnexa was estimated at $2.98 billion ($2.58 billion being 'allocated' expenditure). This equates to approximately $5,183 per person with vision loss aged over 40. By comparison, Centre for Eye Research Australia and Access Economics (2004) estimated allocated health system expenditure on eye disorders was $1.82 billion in 2004. In real terms this is an increase of 4.75% of the 2004 amount per year, in the five year period.

The 2009 estimate for 'allocated' health system expenditure is approximately 1.41 times the 2004 estimate (ie, a 41% nominal increase over 5 years). As a source of comparison, the AIHW (2010) notes that total allocated health system expenditure for all diseases increased by approximately 33% between 2000-01 and 2004-05.

4.3.1 Cost components

The composition of allocated health system costs in 2009 is shown in Chart 4.6.

Chart 4.6: Allocated health system expenditure, 2009 (total $2.58 billion)(a)



(a) Including presbyopia.

Source: Access Economics using AIHW 2004-05 and 2000-01 special request expenditure data, PBS data 2008-09 (Medicare, 2010), AIHW National Hospital Morbidity data for 2004-05 and 2007-08 and special request Medicare cataract surgery data for 2004-05 and 2007-08

Compared to the 2004 health system costs presented in Clear Insight, key points on 2009 cost components are:

- Hospital costs remained the largest component, but fell as a share of total expenditure, from 38% in 2004 to 34% in 2009, increasing by $101 million in 2009 dollar terms over the period.
- Spending on pharmaceuticals comprised a much greater component of total expenditure in 2009, 17%, as compared to 11% of expenditure in 2004. This represented an increase of $207 million in 2009 dollar terms, over the period.
- The out-of-hospital medical services (un-referred attendances, imaging, pathology and other), aged care, research and optometry shares of total health spending in 2009 were roughly similar to their shares in 2004.

Comparisons of allocated cost components between 2004 and 2009 are presented in Table 4.22, with the 2004 estimate having been converted to 2009 dollars by adjusting for health inflation.

Table 4.22: Allocated health system costs, 2009 ($m)(a)

Component	2004(b)	2009
Hospitals	776	877
Out-of-hospital medical	456	538
Pharmaceuticals	234	441
Aged care	113	122

Component	2004(b)	2009
Optometry	210	267
Research	41	101
Other health professionals	217	235
Total	**2,046**	**2,580**

(a) Including presbyopia. (b) Inflated to 2009.

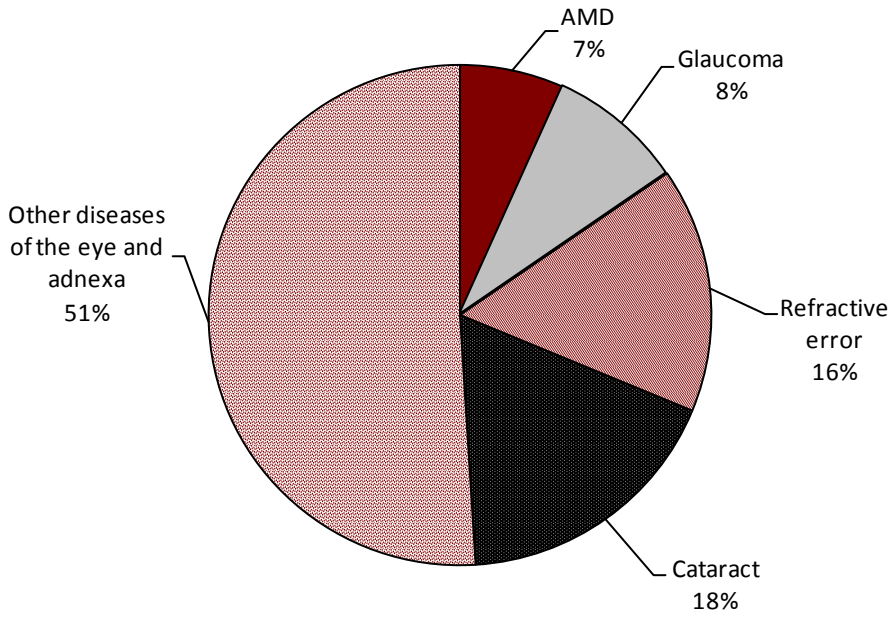
Source: Access Economics using AIHW 2004-05 and 2000-01 special request expenditure data, PBS data 2008-09 (Medicare, 2010), AIHW National Hospital Morbidity data for 2004-05 and 2007-08 and special request Medicare cataract surgery data for 2004-05 and 2007-08

4.3.2 Health system costs by condition

The share each disease category contributed to estimated allocated expenditure in 2009 is shown by Chart 4.7.

More granular data enabling a further breakdown of the 'other diseases of the eye and adnexa' are unfortunately not available (and were not available for the previous report) and so 'other' was estimated by inflating 2000-01 cost data from Centre for Eye Research Australia and Access Economics (2004). This category includes diabetic retinopathy together with conjunctivitis and other eye conditions included in the international classification of diseases code, 'other nervous system and sense organ disorders'.

Chart 4.7: Allocated health system expenditure in 2009 by condition (total $2.58 billion)(a)



(a) These data reflect expenditure on diseases of the eye and adnexa, including presbyopia.

Source: Access Economics using AIHW 2004-05 and 2000-01 special request expenditure data, PBS data 2008-09 (Medicare, 2010), AIHW National Hospital Morbidity data for 2004-05 and 2007-08 and special request Medicare cataract surgery data for 2004-05 and 2007-08

Compared to the 2004 health system costs presented in Clear Insight, key points on 2009 disease components are:

- After inflating the 'other diseases' category from 2000-01 data and adding to the 2009 total, it continued to comprise the largest component of allocated health system costs, although its share fell from 59% in 2004 to 51% in 2009.
- The cataract and glaucoma 2009 shares of total allocated expenditure were roughly similar to their shares in 2004. Refractive error increased its share of total allocated costs, from 14% in 2004 to 16% in 2009. Cataract continued to be the largest single disease cost category in 2009, at 18% in 2009.
- AMD's share of total allocated expenditure rose substantially from 2004 to 2009, from 1% to 7%. This is largely due to the addition of government expenditure on Lucentis in 2008-09, which contributed $151 million to total AMD expenditure. It should be remembered that the 2004 AMD amount did not account for expenditure on Visudyne therapy. Clear Insight (Centre for Eye Research Australia and Access Economics, 2004) noted that AMD costs were likely to have been three times the estimated 2004 amount with the inclusion of the Visudyne program.

Comparisons of allocated cost components in 2004 and 2009 are presented in Table 4.23. Since the 'other diseases of the eye and adnexa' category was extrapolated from Centre for Eye Research Australia and Access Economics (2004), the change in the real dollar amount for this category reflects simply demographic changes and population growth from 2004 to 2009.

Table 4.23: Allocated health system costs by disease, 2009 ($m)(a)

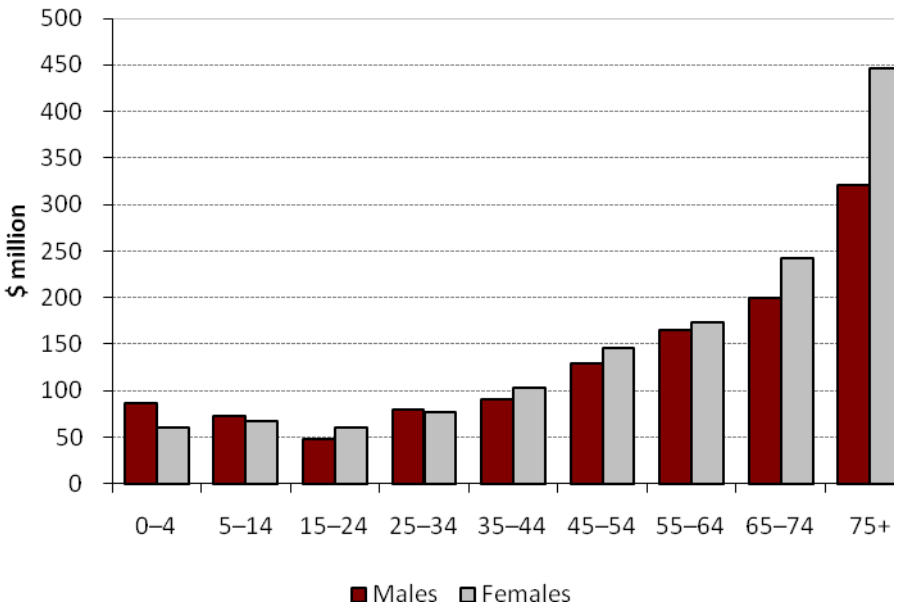
Component	2004(b)	2009
AMD	22	174
Glaucoma	162	224
Refractive error	293	407
Cataract	366	459
Other diseases	1,203	1,316
Total	**2,046**	**2,580**

(a) Including presbyopia. (b) Inflated to 2009.
Source: Access Economics using AIHW 2004-05 and 2000-01 special request expenditure data, PBS data 2008-09 (Medicare, 2010), AIHW National Hospital Morbidity data for 2004-05 and 2007-08 and special request Medicare cataract surgery data for 2004-05 and 2007-08

4.3.3 Health system costs by age group

The pattern of allocated health system costs by age group in 2009 is presented in Chart 4.8. As can be seen, health system costs for diseases of the eye and adnexa have a rising age distribution, with females accounting for larger amounts relative to males, particularly at higher age groups. The highest cost age group in 2009 was the over 75 age group.

Chart 4.8: Allocated health system costs by age group in 2009 ($m)

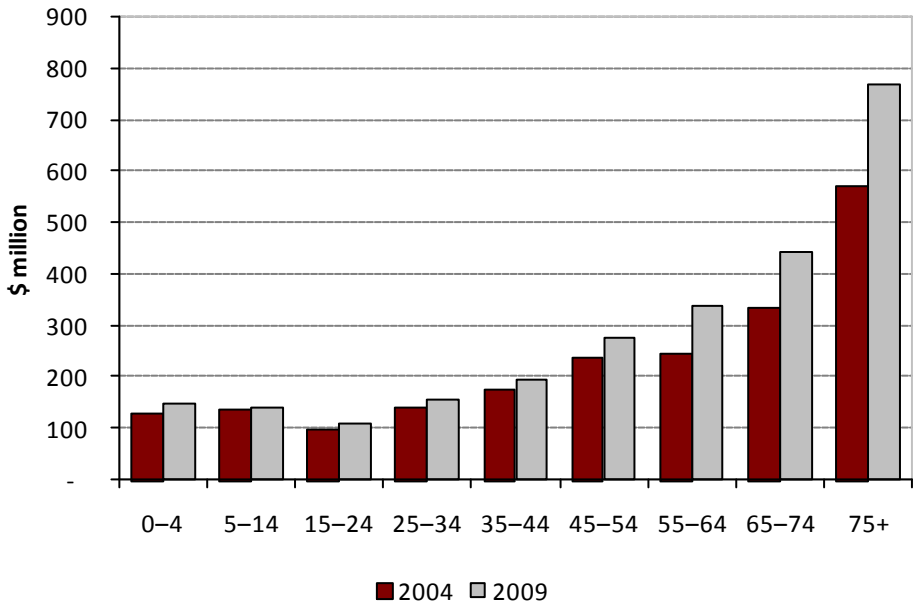


Source: Access Economics using AIHW 2004-05 and 2000-01 special request expenditure data, PBS data 2008-09 (Medicare, 2010), AIHW National Hospital Morbidity data for 2004-05 and 2007-08 and special request Medicare cataract surgery data for 2004-05 and 2007-08

In 2009, those aged 75 or over accounted for approximately 29.7% of total allocated costs. This compares to a lower share in 2004 of 27.9%. This might reflect the larger contribution of AMD costs in 2009, which are particularly skewed towards older age groups. Due to population ageing between 2004 and 2009, the number of persons in older age groups increased.

Chart 4.9 presents the real increase in costs by age group between 2004 and 2009.

Chart 4.9: Allocated health system costs by age group in 2004 and 2009 ($m 2009)



Source: Access Economics using AIHW 2004-05 and 2000-01 special request expenditure data, PBS data 2008-09 (Medicare, 2010), AIHW National Hospital Morbidity data for 2004-05 and 2007-08 and special request Medicare cataract surgery data for 2004-05 and 2007-08

4.3.4 The distribution of health system costs

The AIHW (2009) stated that, of total health expenditures in 2007-08 in Australia:

- The commonwealth government funded 43.2%;
- State and territory governments funded 25.5%;
- Individuals funded 16.8%;
- Private health insurers funded 7.6%; and
- Other sources funded 6.9%

This funding distribution was applied to total health system costs on eye disease in 2009 ($2.98 billion) in Table 4.24.

Table 4.24: Distribution of health system costs on eye disease in 2009

Group	Amount ($m)
Federal Government	1,287
State and Territory Governments	760
Individuals	501
Private health insurers	226
Other	206
Total	**2,980**

Source: Access Economics calculations using ABS 6345.0 and 6310.0 (2010)

4.4 Health expenditure projections to 2020

4.4.1 Factors that affect projections of health expenditure

The projections presented here are based on health inflation and demographic projections. Projected rises in spending are largely driven by population ageing.

Demographic ageing of Australia's population has been a significant contributor to health care spending in the past, and is projected to drive overall future spending, given the demand for health care is highly correlated with age (National Health and Hospitals Reform Commission, NHHRC 2009). The third Intergenerational Government Report (IGR3) highlights the persisting economic and fiscal pressures of an ageing population and noted that Australia's total population growth will increase future demand for health care (The Treasury 2010).[5]

The projections of health spending in this report reflect current knowledge and clinical approaches, and do not make assumptions about advances in medical technology. The impact of technological change is difficult to predict. It may add to the set of services available, and/or replace some. Innovation in prevention may reduce the prevalence of vision loss. Improvements in effectiveness may reduce the need for further care at later stages of disease, or limit the need for repeat procedures over time. Improvements in quality or effectiveness may also be associated with higher unit service costs. Consumer expectations may also change, for example, becoming more aware of what is available, or demanding procedures at earlier stages of disease.

Changes in eye health care implemented on a wide scale before 2020, or evolution in consumer expectations would necessitate a re-estimate of these projections.

At any given point in time, use of health services reflects current policy settings, including funding arrangements, patient co-payments and government subsidies, service quality standards, and other factors affecting access to services. Changes to the structure of the health system, for example through current reform processes, may also affect the veracity of the projections in this report, if they lead to substantial changes in either volumes of services provided or in the unit cost of those services between now and 2020.

[5] The Treasury estimates that Australia's population will grow by over 65% to reach over 35 million in 2049, from approximately 21.5 million currently (The Treasury, 2009). This is a significantly higher projection than the IGR2 projection of 28.5 million in 2047, and is driven by greater women of childbearing age in the population, increasing fertility rates and increased net overseas migration.

4.4.2 Projections

In 2009, there were approximately 575,000 Australians aged over 40 with vision loss from all causes, growing to approximately 801,000 Australians aged over 40 with vision loss in 2020 (see Section 2.6.2). This is an increase of approximately 39% over an 11 year period. Over the same period, the total population (all ages) is estimated to increase by only 18%, while the over 40 population is estimated to increase 23%.

The following health expenditure projections were estimated by:

- applying a health inflation rate of 3.4% per annum, based on historical trend health inflation over the past decade from 1997-98 to 2007-08 (AIHW, 2009); and
- applying projected population growth rates between 2009 and 2020 in each age and gender category.

Thus, projections reflect a continuation of past trends and should be interpreted with caution.

Table 4.25 presents total allocated health system costs by component in 2009 and 2020, as well as the share each component contributes to total costs. Overall, allocated health system costs are estimated to rise to $4,766 million by 2020 or $5,950 per person with vision loss over 40 years. This compares to a total allocated cost of $2,580 million in 2009 ($4,489 per person with vision loss over 40). Using past trend health inflation and demographic estimates, the share of each cost component is expected to remain roughly constant.

Table 4.25: Allocated health system costs - projections to 2020(a)

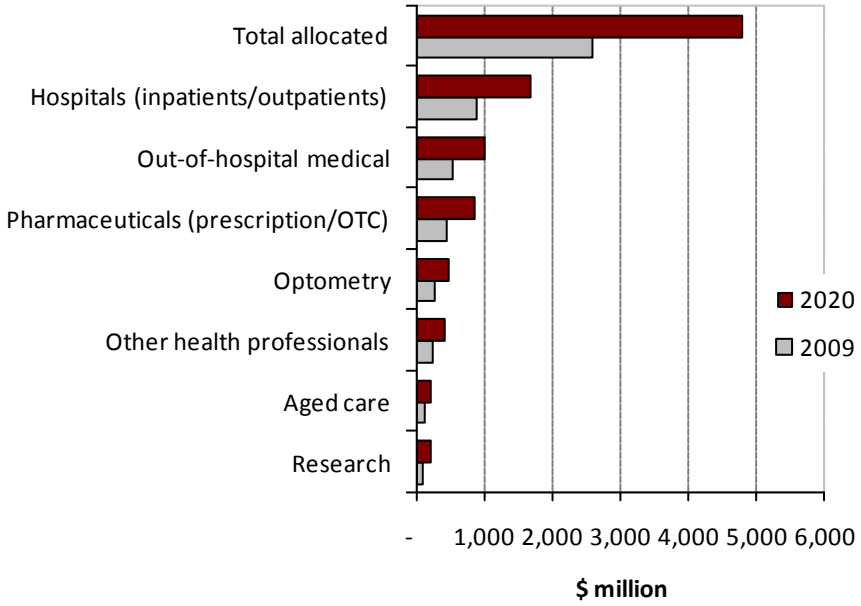
Cost component	2009 total costs ($m)	2009 share (%)	2020 total costs ($m)	2020 share (%)
Research	101	3.9%	187	3.9%
Aged care	122	4.7%	211	4.4%
Other health professionals	235	9.1%	415	8.7%
Optometry	267	10.4%	467	9.8%
Pharmaceuticals	441	17.1%	852	17.9%
Out-of-hospital medical	538	20.7%	981	20.6%
Hospitals	877	34.1%	1,653	34.7%
Total allocated	**2,580**	**100.00%**	**4,766**	**100.00%**

(a) Includes presbyopia.

Source: Access Economics calculations using AIHW (2009), AE-Dem population growth estimates, using AIHW 2004-05 and 2000-01 special request expenditure data, PBS data 2008-09 (Medicare, 2010), AIHW National Hospital Morbidity data for 2004-05 and 2007-08 and special request Medicare cataract surgery data for 2004-05 and 2007-08

Chart 4.10 further illustrates the projected increase in allocated health system costs between 2009 and 2020.

Chart 4.10: Allocated health system costs ($m), 2009 and 2020

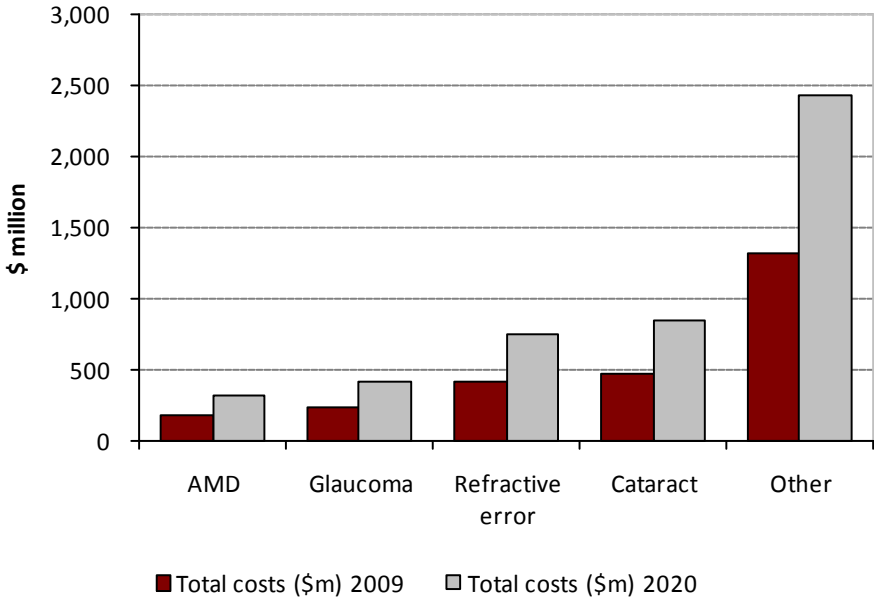


Source: Access Economics calculations using AIHW (2009), AE-Dem population growth estimates, using AIHW 2004-05 and 2000-01 special request expenditure data, PBS data 2008-09 (Medicare, 2010), AIHW National Hospital Morbidity data for 2004-05 and 2007-08 and special request Medicare cataract surgery data for 2004-05 and 2007-08

Chart 4.11 presents the projected increase in allocated health system costs between 2009 and 2020, by disease group. Disease-based projections were estimated by holding constant the proportion each disease contributed to total allocated cost in 2009. Using this approach:

- Glaucoma costs are projected to increase from $224 million to $415 million.
- Cataract costs are projected to increase from $459 million to $847 million.
- AMD costs are projected to increase from $174 million to $321 million.
- Costs of refractive error are projected to increase from $407 million to $753 million.
- Other disease costs are projected to increase from $1,316 million to $2,431 million.

Chart 4.11: Allocated health system costs ($m), by disease, 2009 and 2020



Source: Access Economics calculations using AIHW (2009), AE-Dem population growth estimates, using AIHW 2004-05 and 2000-01 special request expenditure data, PBS data 2008-09 (Medicare, 2010), AIHW National Hospital Morbidity data for 2004-05 and 2007-08 and special request Medicare cataract surgery data for 2004-05 and 2007-08

5 Other financial costs

5.1 Productivity losses

In this report, estimated productivity losses include lower than average employment rates for those living with vision loss, lost lifetime earnings due to premature death attributable to vision loss, and 'bring forward' of employers' search and hiring costs resulting from premature death. Illness and disease more generally may lead to productivity losses where they result in higher than average absenteeism, and lower than average productivity at work ('presenteeism costs'). These elements of potential productivity losses are typically difficult to measure and Australian studies with comparative data were not available for this report.

Other types of productivity losses not included in the estimates here reflect:

- Discouraged workers — those who would like a job, but have given up looking for work because of lack of success in the labour market and who believe this is a direct result of their low vision. The survey by Vision Australia (2007) suggested the discouraged worker effect is substantial among blind people and those with low vision. Their data showed around 40% of those who are blind or have low vision were discouraged compared with 7.3% of Australians of working age in 2007.
- The underemployed — those who are employed but would like to work more hours. Vision Australia (2007) estimated that underemployment among those who are blind or who have low vision is twice that of the average.

Access Economics adopts a human capital approach to the estimation of productivity losses in developed countries.

5.1.1 Vision loss employment studies

Centre for Eye Research Australia and Access Economics (2004) used MVIP data to estimate the impact of vision loss on employment rates, and these estimates are used again here. After adjusting for differences in the age and gender distribution of the MVIP sample, people with vision loss aged 40 to 64 years were 27.5% less likely to be employed than the general population and people with vision loss aged 65 or over were 4.5% less likely to be employed.

A new study of employment of those with low vision was conducted by Vision Australia (Vision Australia 2007). Findings were based on a telephone survey of approximately 2,000 Australians aged 15 to 64 who were blind or had low vision (ie: low vision that could not be corrected by glasses). It was reported that, in 2007, approximately 30.8% persons in the working age low vision/blind sample were employed, while 64.5% of the general working age population in 2007 was employed. This is an estimated employment difference of 33.7%, which is substantially higher than that found by MVIP. The findings were based on a telephone survey of approximately 2,000 Australians aged 15 to 64 who were blind or had low vision (ie: vision loss that could not be corrected by glasses).

The advantage of the Vision Australia survey was that its aim was to investigate the impact of low vision on employment, whereas the MVIP was principally an epidemiological study. However, the MVIP was preferred for this report because:

- The MVIP had a much larger sample size of 4,744 participants, as compared to 1,864 participants in the Vision Australia study. Additionally, the MVIP sample is likely to have been less biased and more representative, due to random sampling.
- The Vision Australia (2007) sample was taken from clients of Vision Australia and those who responded to promotional activities. The study notes risk of bias, due to prioritisation of calls from those who volunteered to take part in the survey. Additionally, potential participants knew of services available to those with low vision and thus may have been in a more favourable position than those who did not know of services.
- The MVIP findings are available for people aged over 64 years, while the Vision Australia analysis excluded this group.
- Respondents' levels of vision were self-declared in the Vision Australia survey, whereas the MVIP study involved completion of a standardised interview and eye examination by a clinician.

5.1.2 Employment participation

Vision loss can affect a person's ability to gain employment. Due to lower than average employment rates for people with vision loss, this loss in productivity represents a real cost to the economy, through a loss in earnings (and consequently, taxation revenue earned). The MVIP study indicated that those with vision loss aged 40-64 were 27.5% less likely to be employed than those in the 40-64 general population, while those aged over 65 were 4.5% less likely to be employed.

To derive productivity losses from lower employment, these employment difference parameters were applied to estimates of the 2009 vision loss population in each age group and the latest age-specific average weekly earnings data (ABS, 2010). A maximum working age of 74 was assumed, and thus the 4.5% employment difference was applied only to vision loss people aged 65 to 74.

Average weekly earnings (AWE) data from 2008 (latest available) were inflated to 2009 dollars, using the labour price index between June 2008 and June 2009 (ABS, 2010). AWE estimates for all workers (full-time and part-time) are presented in Table 5.26.

Table 5.26: AWE for full-time and part-time employed in 2009

Age group	AWE ($)
40-44	1163
45-49	1134
50-54	1114
55-59	1040
60-64	1047
65-69	861
70-74	861

Source: Access Economics calculations using ABS 6345.0 and 6310.0 (2010)

Productivity losses reflecting the impact of vision loss on the likelihood of employment compared with the average in 2009 were approximately $2.27 billion (Table 5.27).

Table 5.27: Productivity loss due to lower employment, 2009

Age group	Productivity loss ($m)
40-44	163,052
45-49	158,933
50-54	508,542
55-59	474,483
60-64	723,248
65-69	96,969
70-74	141,203
Total	**2,266,429**

Source: Access Economics calculations using ABS 6345.0 and 6310.0 (2010), VIP study prevalence and employment rate estimates and AE-Dem population estimates

5.1.3 Premature death

From the calculations in Section 3, there were an estimated 1,111 deaths attributable to vision loss in 2009. Of these, there were an estimated 126 deaths attributable to vision loss in the 40 to 74 age group (assumed to be working age group in this report).

Based on this case mortality risk, and incorporating employment rates and estimates of average lifetime earnings for different age-gender groups, the present value of lost earnings due to mortality was estimated to be $12.26 million in 2009 (at a discount rate of 3% per annum).

Premature death also imposes search and hiring costs for employers to replace lost employees. Calculations of this component were based on a 3% discount rate, an assumed replacement and retraining time of 26 weeks (Access Economics 2004), years until next turnover estimate of three years (Access Economics 2004), and data on employment rates and AWE (ABS 2009, 2010). It was estimated that search and hiring costs imposed on employers in 2009 were $64,900. Total productivity losses due to premature death in 2009 were $12.3 million (breakdown provided in Table 5.28).

Table 5.28: Productivity losses due to premature death, 2009

Age group	Lost lifetime earnings ($)	'Bring forward' of employers' search and hiring costs ($)
40-44	893,670	2,335
45-49	357,722	1,133
50-54	3,229,305	12,625
55-59	3,137,379	15,365
60-64	2,726,895	17,829
65-69	1,372,942	10,727
70-74	543,259	4,886
Total	**12,261,173**	**64,900**

Source: Access Economics calculations using ABS (2009, 2010), VIP study prevalence and employment rate estimates and AE-Dem population estimates

5.1.4 Distribution of productivity losses

Different productivity loss components were imposed on different sections of society, with employees bearing most of the burden through lost lifetime earnings totalling almost $1.6 billion.

Reduced earnings from lower employment participation and premature death result in reduced taxation revenue collected by the government. As well as forgone income (personal) taxation, there is also a fall in indirect (consumption) tax, as those with lower incomes spend less on the consumption of goods and services. Lost taxation revenue to the government was estimated by applying an average personal income tax rate and average indirect taxation rate to lost earnings. Rates in 2008-09 were 19.6% and 11.8%, respectively (taken from Access Economics' Macroeconomic Model, AEM). Lost taxation revenue from vision loss in 2009 was approximately $715.5 million.

Employers bore employee replacement costs of approximately $65,000 due to premature death.

The distribution of estimated productivity losses by age group is provided in Table 5.29.

Table 5.29: Distribution of productivity losses, 2009($)

Age group	Incurred by employee	Incurred by employer	Incurred by government
40-44	112,466,992	2,335	51,479,060
45-49	109,273,216	1,133	50,017,186
50-54	351,075,056	12,625	160,696,163
55-59	327,647,546	15,365	149,972,784
60-64	498,018,445	17,829	227,955,965
65-69	67,462,594	10,727	30,879,380
70-74	97,237,828	4,886	44,508,277
Total	**1,563,181,677**	**64,900**	**715,508,814**

Source: Access Economics calculations

5.2 Informal care costs

Informal carers are people who provide care to others in need of assistance or support on an unpaid basis. Most informal carers are family or friends of the person receiving care. Carers may take time off work to accompany people with vision loss to medical appointments, stay with them in hospital, or care for them at home. Carers may also take time off work to undertake many of the unpaid tasks that the person with vision loss would do if they did not have vision loss and were able to do these tasks.

Informal care is distinguished from services provided by people employed in the health and community sectors (formal care) because the care is generally provided free of charge to the recipient and is not regulated by the government. While informal care is provided free of charge, it is not free in an economic sense, as time spent caring is time that cannot be directed to other activities such as paid work, unpaid work (such as housework or yard work) or leisure. As such, informal care is a use of economic resources.

5.2.1 Methodology

There are three potential methodologies that can be used to place a dollar value on the informal care provided:

- **The opportunity cost method** values earnings foregone by the carer, in caring for the person with vision loss.
- **The replacement valuation method** estimates the cost of buying a similar amount of services from the formal care sector.
- **The self valuation method** sums the costs of what carers themselves feel they should be paid for the care provided to the person with vision loss.

Access Economics has adopted the opportunity cost method in this report because sufficient demographic data on providers of care for people with vision loss has become available since the previous Clear Insight study (Centre for Eye Research Australia and Access Economics 2004).

Data from the 2003 Survey of Disability Ageing and Carers (SDAC) (ABS, 2004) for vision loss were specially requested from the ABS to gain estimates of the total number of carers and hours of primary care provided to people with vision loss. SDAC data identified 40,300 informal carers (primary and non-primary) whose main recipient of care had a disease of the eye and adnexa. Of these, approximately 39,400 carers were identified as being aged over 15 years. Of the 39,400 carers, 3100 were aged less than 40 years, 21,400 carers were aged 40 to 64 years and 14,900 aged 65 years and over.

The SDAC data were also used to estimate average weighted primary care hours provided to those with an eye disease in 2003 — approximately 24.4 hours per week. Access Economics (2005) conducted a previous study on informal care using SDAC 2003 data. This estimated that non-primary carers provided an average of five hours of care per week. Using Access Economics' (2005) carer study, it was estimated that, in 2003:

- Of informal carers aged less than 40 years, 11.5% were primary carers;
- Of informal carers aged between 40 to 65 years, 21.5% were primary carers;

- Of informal carers aged 65 and over, 24.9% were primary carers; and
- Approximately 29% of primary carers were male, while nearly 50% of non-primary carers were male.

This distribution was applied to the 39,400 total carers to obtain an estimated breakdown by carer status (primary/non-primary) and gender. A 2003 population distribution obtained from AE-Dem was applied to further refine estimates to the five year age-gender group level.

Age-specific population growth rates between 2003 to 2009 (AE-Dem) were applied to the estimate of 39,400 carers in 2003, to estimate that there were 41,500 total carers in 2009, 9,100 of these being primary carers and 32,400 being non-primary.

Applying age-gender specific estimates of primary and non-primary carers in 2009, employment rates and AWE in 2009 (ABS 2009, 2010) to approximated carer hours in 2009, it was estimated that lost earnings of carers in 2009 totalled $251 million. This is equivalent to approximately $437 per person (aged over 40) with vision loss in 2009.

In Clear Insight (Centre for Eye Research Australia and Access Economics 2004) carer productivity losses were estimated by applying an annual estimate for lost carer productivity, taken from a CERA study on indirect costs (Chou and Keefe 2004), to the number of persons with low vision over 40. This was approach was used due to lack of available data at the time on carers of those with eye disease. If the older method is applied for 2009, the resulting estimate of carer productivity losses would be close to $819 million.[6] However, since it is based on actual SDAC data on carers of those with eye disease (ABS 2004), the $251 million estimate is included in the total cost of vision loss in 2009, with this new method being preferable to the approach used in the Clear Insight study.

Of the total $251 million opportunity cost of informal care, $172 million was incurred by carers and around $79 million borne by government in the form of lost tax revenue (using taxation rates in section 5.1.4). This breakdown is presented in Table 5.30.

Table 5.30: Opportunity cost of informal care for those with vision loss, 2009($)

Age group	Incurred by carer (family/friends)	Incurred by government (lost tax revenue)	Total cost
<40	11,568,700	5,295,294	16,863,995
40-44	38,319,015	17,539,607	55,858,622
45-49	37,972,904	17,381,183	55,354,087
50-54	31,995,497	14,645,169	46,640,667
55-59	24,559,783	11,241,650	35,801,434
60-64	13,010,347	5,955,174	18,965,521
65-69	13,014,638	5,957,137	18,971,775

[6] Inflating the 2003 carer productivity annual mean cost of $1,228 (Chou and Keefe, 2004) to 2009 produces an estimated annual mean cost of approximately $1,424 in 2009. Applying this cost to the number of vision impaired persons in 2009 (ie, 574,895 persons with vision loss, aged over 40) results in an estimated carer productivity cost of $818.8 million.

Age group	Incurred by carer (family/friends)	Incurred by government (lost tax revenue)	Total cost
70-74	1,919,609	878,655	2,798,264
Total	**172,360,494**	**78,893,870**	**251,254,364**

Source: Access Economics calculations

5.3 Funeral costs

The 'additional' cost of funerals borne by family and friends of people with vision loss is based on the additional likelihood of death associated with vision loss (Section 3) in the period that the person experiences it. However, some patients (particularly older patients) would have died during this time anyway. Eventually everyone must die and thus incur funeral expenses – so the true cost is the cost brought forward (adjusted for the likelihood of dying anyway in a given year).

The Bureau of Transport and Road Economics (2000) calculated a weighted average cost of a funeral across all states and territories, to estimate an Australian total average cost of $3,200 per person for 1996, or $4,392 per funeral in 2009.

The bring forward of funeral costs associated with premature death for people with vision loss was almost $785,000 in 2009.

5.4 Welfare payments

Welfare payments may be received by those with low vision and/or their carers, including the:

- **Newstart Allowance (NSA)** which is an activity-tested income support payment for persons looking for work, aged 21 to 64.
- **Disability Support Pension (DSP)** which provides income support for those with a physical or mental disability and is designed for those who are unable to work at least 15 hours per week, at or above the relevant minimum wage, independent of a program or support.
- **Carer Payment** which is an income support payment for people unable to support themselves through participation in the workforce, while caring for someone with a disability, severe medical condition or who is aged.
- **Carer Allowance** which is a supplementary payment for carers who provide daily care and attention at home for a person with a disability, severe medical condition, or who is aged. This may be paid in addition to income support payments.
- **Sickness Allowance** is an income support payment for persons aged 21 to 64 who are employed and temporarily unavailable to work due to a medical condition.
- **Aged Pension (Blind)** is available to those who are legally blind and satisfy specific age and residence requirements. This pension is assessed differently to the usual Aged Pension and so it may be of benefit for those who are blind and on the Aged Pension to transfer to the Aged Pension (Blind).
- **Travel concessions** including the Vision Impaired Person's Travel Permit in NSW and the Vision Impaired Travel Pass (VITP) in Victoria, which entitles those with significant low

vision or legal blindness (for VITP) in these regions to free travel on trains, buses and other public transport. Additionally, the Action Buses government bus service in the ACT provides free bus travel to people who are blind or have low vision and their carers

Because the travel concessions described above apply to specific regions, these weren't included in the estimation of costs. Additionally, the Aged Pension (Blind) wasn't included due to the availability of the general Aged Pension to the over 65 Australian population.

Data on recipients of welfare payments in June 2009 were specially requested from Centrelink. For the NSA and Sickness Allowance, the number of recipients could be provided at the specific level of eye diseases. However, Sickness Allowance recipients were excluded from calculations as there were reported to be less than 20 recipients in Australia overall, with no further breakdown available. Additionally, because Sickness Allowance qualification requires that the recipient have a temporary incapacity to work, the eye condition may not be the primary qualifying condition for this allowance.

Data on recipients of welfare payments in June 2009 were specially requested from Centrelink. For the NSA, the number of recipients could be provided at the specific level of eye diseases. Due to data limitations, data on the DSP, Carer Payment and Carer Allowance could only be provided at the level of 'sensory disorders'. Sensory disorders are defined by Centrelink as:

- Hearing disorders including complete and partial hearing loss, tinnitus, vertigo, Meniere's Disease;
- Speech disorders including complete loss of speech and stuttering;
- Vision disorders including blindness in one or both eyes, cataracts, glaucoma and low vision in one or both eyes; and
- Combined sensory disorder, ie, deafness/blindness.

From SDAC 2003 data (ABS 2004), it was estimated that those disabled with a disease of the eye and adnexa as their main condition constituted approximately 24.9% of total persons disabled with either a disease of the eye and adnexa or ear and mastoid as their main condition. The calculated fraction was applied to estimated recipients with sensory disorders on the DSP, Carer Payment and Carer Allowance to estimate recipients with eye disease. Due to limited data, those disabled with a speech disorder and combined sensory disorder could not be included in the calculation of this fraction. Due to this limitation, estimates of recipients with eye disease on these welfare payments are only approximations, and should be interpreted with caution.

Table 5.31 presents estimates of the number of welfare recipients with, or caring for, a person with eye disease in 2009, fortnightly payment rates in 2009 (Centrelink 2009) and calculated total payments made. Overall, it is estimated that nearly $182.6 million was paid out in welfare payments to persons with eye disease and their carers in 2009.

Table 5.31: Estimated welfare payment recipients(a), payment rates(b) and total payments in 2009

Payment type	Estimated recipients	Payment rate ($)	Total payments made ($m)
NSA	4,959	570	73.5
DSP*	1,460	453	17.2
Carer Payment*	4,061	570	60.2
Carer Allowance*	11,618	105	31.7
Total	**22,097**		**182.6**

(a) Estimated recipients with eye disease (DSP and NSA) or caring for a person with eye disease in 2009 (Carer Payment and Carer Allowance).
(b) Fortnightly rate for singles with no children in 2009, given to the nearest dollar.
* Recipients for these categories were estimated by applying a 24.9% fraction to total recipients for the 'sensory disorder' category in Centrelink data – see discussion above
Source: Access Economics calculations using special request data from June 2009 from Centrelink and Centrelink publication (2009)

5.5 Deadweight losses from transfers

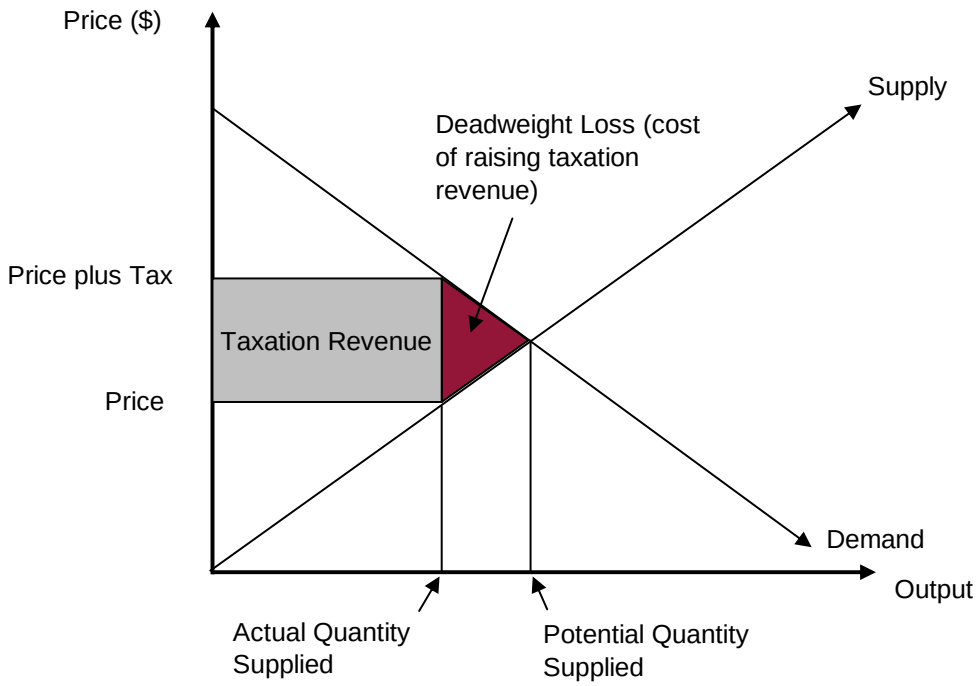
The welfare payments calculated immediately above are, like taxation revenue losses, not themselves economic costs but rather a financial transfer from taxpayers to the income support recipients. The real resource cost of these transfer payments is only the associated deadweight loss (DWL).

Deadweight Losses refer to the costs of administering welfare pensions and raising additional taxation revenues. Although invalid and sickness benefits and forgone taxation are transfers, not real costs (so should not be included in the estimation of total costs), it is still worthwhile estimating them as that helps us understand how the total costs of low vision are shared between the taxpayer, the individual and other financiers.

Transfer payments (government payments/services and taxes) are not a net cost to society as they represent a shift of consumption power from one group of individuals to another in society. If the act of taxation did not create distortions and inefficiencies in the economy, then transfers could be made without a net cost to society. However, through these distortions, taxation does impose a DWL on the economy.

DWL is the loss of consumer and producer surplus, as a result of the imposition of a distortion to the equilibrium (society preferred) level of output and prices. Taxes alter the price and quantity of goods sold compared to what they would be if the market were not distorted, and thus lead to some diminution in the value of trade between buyers and sellers that would otherwise be enjoyed (Chart 5.12).

Chart 5.12: DWL of taxation



Source: Access Economics

The rate of DWL used in this report is 27.5 cents per dollar of tax revenue raised plus 1.25 cents per dollar of tax revenue raised for Australian Taxation Office administration, based on Productivity Commission estimates (2003), in turn derived from Lattimore (1997). This is a rate of 28.75% overall. The total extra tax dollars required to be collected include (figures have been rounded):

- Lost taxation revenue as a result of vision loss, including $715.5 million for persons with vision loss (Section 5.1.4) and $78.9 million for carers (Section 5.2.1);
- The value of government welfare payments paid out to carers and to those with vision loss, estimated at $182.6 million (Section 5.4); and
- The government funded component of health system costs, estimated to be approximately $2.0 billion (Section 4.3.4).

Summing these components and applying the DWL rate of 28.75% results in a DWL estimate of approximately $869 million in 2009, associated with vision loss.

5.6 Other indirect costs: aids, home modifications and other carer

Aids and home modifications are those not captured in formal health sector or disability services costs that include equipment and technology in order to assist with daily living. People with low vision may require a variety of aids, special equipment and home modifications to function adequately and to enhance their quality of life. Some of these are listed below:

- alternative format materials eg, large print or Braille publications, labels and tags, locator dots;

- mobility aids – canes, guide dogs, torches;
- glasses, sunglasses (glare reducing);
- low vision devices – magnifiers, telescopes and closed circuit TVs;
- computer aids – eg computer speech technology, large print or Braille display;
- daily living aids – clocks and watches, coin sorters, bathroom and kitchen accessories (eg, liquid level indicators, needle-threaders), sport and recreation items (eg embossed dice or playing cards, ringing balls);
- recording and playback devices;
- talking appliances (eg talking calculators, scales, thermometers);
- educational aids for visual, audio or tactile learning; and
- enhanced lighting, grab rails.

Centre for Eye Research Australia and Access Economics (2004) used two different studies to derive the costs of aids and home modifications.

Frisch (2001) undertook detailed survey work of the costs of indirect items in Australia for people with disabilities. It developed a set of mean annualised costs from the Department of Family and Community Services' Survey of Disability Support Pensioners and originally reported in Walsh and Chappell (1999).

Centre for Eye Research Australia (2003) conducted a study of indirect costs that included the costs of carers specifically for people with low vision. This study combines retrospective questionnaires and prospective diaries, together with regular personal contacts and follow-up, to record over one year a number of indirect costs under the categories of:

- medicines, products and equipment;
- health and community services;
- informal care and support; and
- other expenses.

The 'informal care and support' component listed includes the costs associated with assistance in daily living such as home help, meal preparation, gardening, shopping, banking, social outings and reading mail and transportation. Since this is separate to the productivity losses resulting from informal care (estimated in Section 5.2.1), this component was included in the estimation of costs in this report.

Table 5.32 presents the set of mean annualised costs per person from combining the Centre for Eye Research Australia and Frisch studies (Centre for Eye Research Australia and Access Economics 2004), inflated to 2009. These were multiplied by the number of people with low vision in 2009 (574,895) to obtain total costs. The total cost of aids, modifications and informal care (excluding productivity losses) was estimated at $838.7 million in 2009.

Table 5.32: Indirect financial costs for people with vision loss, 2009 ($)

Cost component	Annual mean cost per person ($)	Total cost in 2009 ($m)
Informal care and support*	566	325.2
Aids and equipment	379	218.0
Other (exc. health services)	514	295.5
Total	**1,459**	**838.7**

* Excludes carer productivity losses.
Source: Centre for Eye Research Australia and Access Economics (2004) using Frisch (2001) and CERA (2003), inflated to 2009 at 2.5% per annum

5.7 Summary of other financial costs

Other financial costs associated with vision loss were estimated to be approximately $4.2 billion in 2009, with the breakdown presented in Table 5.33.

Table 5.33: Summary of other financial costs associated with vision loss in 2009

Cost type	Total cost ($m)
Productivity losses	2,279
Carer opportunity costs	251
Aids/home modifications/other carer/bring forward of funerals	839
DWL	869
Total	**4,238**

Source: Access Economics calculations

6 Loss of wellbeing in 2009

This chapter presents a quantitative analysis of the costs of pain and suffering from a particular condition. These costs of disability, loss of wellbeing and premature death from vision loss are difficult to measure. Note – the term 'loss of well being' is used throughout this report instead of the well-defined concept in health economics, 'burden of disease' as measured by disability adjusted life years (DALYs). It measures the suffering and premature death from a disease or injury and does not imply that people experiencing disease or injury are a burden on society.

This section estimates the loss of wellbeing in 2009 resulting from vision disorders for persons aged 40 or over. An imputed value of a statistical life year (VSLY) allows us to compare non-financial costs such as loss of wellbeing with the estimated financial costs of vision loss.

6.1 Methodology

In the last decade, a non-financial approach to valuing human life has been derived, where loss of wellbeing and premature mortality are measured in terms of Disability Adjusted Life Years (DALYs). This approach was developed by the WHO, the World Bank and Harvard University for a study that provided a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990, projected to 2020 (Murray and Lopez 1996). Methods and data sources are detailed further in Murray et al (2001) and the WHO continues to revisit the estimates for later years.

A DALY of 0 represents a year of perfect health, while a DALY of 1 represents death. Other health states are attributed values between 0 and 1 as assessed by experts on the basis of literature and other evidence of the quality of life in relative health states. For example, the *disability weight* of 0.18 for a broken wrist can be interpreted as losing 18% of a person's quality of life relative to perfect health, because of the inflicted injury. Total DALYs lost from a condition are the sum of the mortality and morbidity components – the Year(s) of healthy Life Lost due to premature death (YLLs) and the Year(s) of healthy life Lost due to Disability (YLDs).

The DALY approach has been successful in avoiding the subjectivity of individual valuation and is capable of overcoming the problem of comparability between individuals and between nations, although some nations have subsequently adopted variations in weighting systems, for example age-weighting for older people. This report treats the value of a life year as equal throughout the lifespan.

As these approaches are not financial, they are not directly comparable with most other cost and benefit measures. In public policy making, it is often desirable to apply a monetary conversion to ascertain the cost of an injury, disease or fatality or the value of a preventive health intervention, for example, in cost benefit analysis. Such financial conversions tend to utilise 'willingness to pay' or risk-based labour market studies as described in the next section.

6.1.1 Willingness to pay and the value of a statistical life year

The loss of wellbeing as measured in DALYs can be converted into a dollar figure using an estimate of the **Value of a 'Statistical' Life** (VSL). As the name suggests, the VSL is an estimate of the value society places on an anonymous life. Since Schelling's (1968) discussion of the

economics of life saving, the economic literature has focused on **willingness to pay** (WTP) – or, conversely, willingness to accept – measures of mortality and morbidity, in order to develop estimates of the value of a statistical life (VSL).

Estimates may be derived from observing people's choices in situations where they rank or trade off various states of wellbeing (loss or gain) either against each other or for dollar amounts (eg, stated choice models of people's WTP for interventions that enhance health or willingness to accept poorer health outcomes or the risk of such states). Alternatively, risk studies use evidence of market trade-offs between risk and money, including numerous labour market and other studies (such as installing smoke detectors, wearing seatbelts or bike helmets and so on).

The extensive literature in this field mostly uses econometric analysis to value mortality risk and the 'hedonic wage' by estimating compensating differentials for on-the-job risk exposure in labour markets; in other words, determining what dollar amount would be accepted by an individual to induce him/her to increase the probability of death or morbidity by a particular percentage. Viscusi and Aldy (2002), in a summary of mortality studies, found the VSL ranged between US$4 million and US$9 million with a median of US$7 million (in year 2000 US dollars), similar but marginally higher than the VSL derived from studies of US product and housing markets. They also reviewed a parallel literature on the implicit value of the risk of non-fatal injuries.

Weaknesses in the WTP approach, as with human capital approaches to valuing life and wellbeing, are that there can be substantial variation between individuals. Extraneous influences in labour markets such as imperfect information, income/wealth or power asymmetries can cause difficulty in correctly perceiving the risk or in negotiating an acceptably higher wage in wage-risk trade off studies, for example.

As DALYs are enumerated in years of life rather than in whole lives it is necessary to calculate the **Value of a 'Statistical' Life Year (VSLY)** based on the VSL. This is done using the formula:[7]

$$\mathbf{VSLY = VSL / \Sigma_{i=0,\ldots,n-1}(1+r)^{i}}$$

Where: n = years of remaining life, and
r = discount rate

Clearly there is a need to know *n* (the years of remaining life), and to determine an appropriate value for *r* (the discount rate). There is a substantial body of literature, which often provides conflicting advice, on the appropriate mechanism by which costs should be discounted over time, properly taking into account risks, inflation, positive time preference and expected productivity gains.

Access Economics (2008) recommended an average VSL of $6.0 million in 2006 Australian dollars ($3.7 million to $8.1 million). This equates to an average VSLY in 2006 of $252,014 ($155,409 to $340,219), using a discount rate of 3% over an estimated 40 years remaining life expectancy. However, from this gross value, Access Economics deducts all costs borne by the

[7] The formula is derived from the definition:
VSL = ΣVSLYi/(1+r)^i where i=0,1,2….n
where VSLY is assumed to be constant (ie. no variation with age).

individual, reflecting the source study VSL estimates, to avoid double counting. This provides a different net VSLY for different conditions (and for different age-gender groups).

Since Access Economics (2008) was published, the Office of Best Practice Regulation (OBPR 2009) have also provided an estimate of the VSLY, which appears to represent a fixed estimate of the net VSLY. This estimate was $151,000 in 2006, which inflates to $161,751 in 2009 dollars. This is very similar to the average net VSLY estimated using the Access Economics (2008) meta-analysis, and is used for calculations in modelling here.

6.1.2 Discount rate

In reviewing the literature, Access Economics (2008) found the most common rate used to discount healthy life was 3% and this had a strong rationale.

Choosing an appropriate discount rate is a subject of some debate, as it varies depending on what type of future income or cost stream is being considered. The discount rate needs to appropriately take into account risks, inflation and positive time preference.

The minimum option that one can adopt in discounting future expected healthy life streams and other costs is to set future values on the basis of a risk free assessment about the future i.e. assume the future flows are similar to the certain flows attaching to a long term government bond. From recent history, the long term nominal bond rate has averaged 5.8% per annum. If there were no positive time preference, people would be indifferent between having something now or a long way off in the future, which applies to all goods and services.

The Reserve Bank has a clear mandate to pursue a monetary policy that delivers 2% to 3% inflation over the course of the economic cycle. This is a realistic longer run goal and an inflation rate in this range (2.8%) is used in arriving at the discount rate for healthy life below. It is important to allow for inflation in order to derive a real rather than nominal rate.

In discounting healthy life and other costs, a real discount rate for Australia of 3% is thus suggested (calculated as 5.8% - 2.8% = 3%).

6.2 Loss of wellbeing from vision disorders in 2009

The AIHW has provided comprehensive analysis in the area of assessing DALYs, YLLs and YLDs from various disease and injury conditions in Australia. Since the release of the Clear Insight study (Access Economics 2004), the AIHW has released an updated publication (Begg et al 2007). This study estimated the YLDs and prevalence of the following vision disorders in 2003:

- Glaucoma-related blindness;
- Cataract-related blindness;
- Age-related macular degeneration; and
- Refractive errors.

Additionally, the AIHW also provided estimates of YLDs and prevalence in 2003 for diabetes mellitus, with a YLD breakdown for DR. As such, the loss of wellbeing from DR is also estimated in this report.

Begg et al (2007) did not provide estimates of YLLs, basing their work on an assumption that no-one dies prematurely from vision disorders. Due to this, YLLs were derived from the estimates of premature death attributable to vision loss, calculated in Section 3 of this report.

Centre for Eye Research Australia and Access Economics (2004) excluded refractive errors from its loss of wellbeing calculations, as this category was not included in the older AIHW study available at the time (Mathers et al, 1999). The inclusion of uncorrected refractive errors in this report results in a substantial contribution to loss of wellbeing from vision loss among those aged over 40.

Begg et al (2007) also provided a more specific age breakdown for YLDs and prevalence, and thus DALYs could be estimated specifically for the 40 and over age group, rather than for all age groups, as was done in Centre for Eye Research Australia and Access Economics (2004).

6.2.1 Disability weights and YLDs in 2009

One of the main costs of vision loss is the loss of wellbeing and quality of life that it entails. This can be estimated by initially allocating disability weights to vision disorders that cause vision loss. Disability weights were derived by dividing estimated DALYs in 2003 by estimated prevalence (cases) in 2003 for each vision disorder, both of which were taken from Begg et al (2007).

Begg et al (2007) provided an estimate of YLDs resulting from DR in 2003, at approximately 1,060 YLDs for all persons aged over 40 in Australia. Centre for Eye Research Australia and Access Economics (2004) estimated that 2.9% of persons with DM had vision-threatening DR. To estimate prevalence of DR in 2003, the AIHW-estimated prevalence of DM in Australia in 2003 (approximately 1.09 million cases aged over 40) was multiplied by this fraction of 2.9%. This resulted in an estimated DR prevalence of approximately 31,790 cases.

Estimated disability weights of vision disorders in 2003 are presented in Table 6.34 by age group. Different weights by age reflect the prevalence of comorbidities and the use of a multiplicative model to estimate the disease weight for one condition in the presence of comorbidities.

Table 6.34: Vision disorders - derived disability weights(a)

	Age group					
Vision disorder	**40-49**	**50-59**	**60-69**	**70-79**	**80-89**	**90+**
Glaucoma	1.65	1.11	0.49	0.14	0.05	0.01
Cataract	0.04	0.04	0.03	0.03	0.04	0.06
AMD	-	-	1.03	0.47	0.16	0.08
RE (b)	0.05	0.06	0.07	0.09	0.08	0.06
DR	0.06	0.04	0.03	0.02	0.02	0.01
All vision disorders	**0.06**	**0.07**	**0.08**	**0.11**	**0.09**	**0.06**

(a) Calculated as YLDs in 2003/estimated prevalence in 2003.
(b) Including presbyopia.
Source: Access Economics calculations using Begg et al (2007)

YLDs in 2009 were estimated by multiplying the set of disability weights for all vision disorders by the prevalence of vision loss from each vision disorder, excluding presbyopia (see Section 2). Estimated YLDs from all vision disorders excluding presbyopia in 2009 are presented in

Table 6.35, by age group. It is estimated that overall, there were approximately 51,400 YLDs in 2009 from vision disorders excluding presbyopia, for those aged over 40.

Table 6.35: Estimated YLDs from vision disorders in 2009 (a)

Age group	Disability weight	Prevalence in 2009	YLDs in 2009
40-49	0.06	19,641	1,096
50-59	0.07	63,940	4,516
60-69	0.08	96,753	8,203
70-79	0.11	140,888	16,071
80-89	0.09	198,186	17,982
90+	0.06	55,488	3,542
Total	**0.08**	**574,895**	**51,409**

(a) Excluding presbyopia.
Source: Access Economics calculations using Begg et al (2007)

6.2.2 YLDs from presbyopia

In 2009, presbyopia affected approximately 73,000 people aged over 40 (Section 2.6.2). Age specific prevalence rates for presbyopia were not available. Applying the aggregate disability weight for vision disorders in 2009 (0.08) overestimates the impact of presbyopia on wellbeing because by definition, the disability weights describe the impact on wellbeing of low vision and blindness in people with visual acuity worse than 6/12, whereas presbyopia is defined as binocular near vision worse than N8 reading size with visual acuity of 6/12 or better (Marmamula 2009). Research is needed to understand the impact of presbyopia on wellbeing.

6.2.3 YLLs in 2009

In Section 3, it was estimated that there were an estimated 1,111 deaths in the above 40 age group, attributable to vision loss in 2009. YLLs were estimated from the age-gender distribution of deaths by the corresponding YLLs for the age of death in the Standard Life Expectancy Table (West Level 26), with a discount rate of 3.0% and no age weighting.

In total, there were approximately 6,700 estimated YLLS in 2009, from vision loss (Table 6.36).

Table 6.36: Estimated YLLs from vision disorders in 2009

Age group	Deaths in 2009	Average age at death	YLLs in 2009
40-49	2	45.5	38
50-59	16	55.5	309
60-69	42	65.5	603
70-79	170	75.5	1625
80-89	709	85.5	3732
90+	172	95.5	430
Total	**1,111**		**6,738**

Source: Access Economics calculations

6.2.4 DALYs in 2009

Summing the YLD (excluding presbyopia) and YLL components results in an estimated 58,150 DALYS in 2009, from vision disorders (Table 6.37).

Table 6.37: Estimated DALYs from vision disorders in 2009

Age group	YLDs	YLLs	DALYs in 2009
40-49	1,096	38	1,133
50-59	4,516	309	4,826
60-69	8,203	603	8,806
70-79	16,071	1625	17,695
80-89	17,982	3732	21,714
90+	3,542	430	3,973
Total	**51,409**	**6,738**	**58,147**

Source: Access Economics calculations

Multiplying the total number of DALYs by the VSLY in 2009 ($161,751) provides an estimate of the dollar value loss of wellbeing from vision loss.

The estimated monetary value of the lost wellbeing from vision disorders for those aged over 40 was $9.4 billion in 2009.

Centre for Eye Research Australia and Access Economics (2004) reported an estimate of lost wellbeing of $4.8 billion in 2004 (approximately $5.5 billion in 2009 dollars) applying to the whole vision loss population (not just those over 40). The difference in the lost wellbeing estimates in Centre for Eye Research Australia and Access Economics (2004) and this report can be explained by:

- Centre for Eye Research Australia and Access Economics (2004) excluded lost wellbeing from refractive errors, due to limited data available in Mathers et al (1999), as compared to the recent publication (Begg et al 2007). Excluding refractive errors from the 2009 estimate in this report results in a lost wellbeing figure of approximately $5 billion for those aged over 40.
- A slightly different methodology was employed to estimate YLLs in this report, as compared to Centre for Eye Research Australia and Access Economics (2004). The older report assumed an average life expectancy of 84.2 years and discount rate of 3.3%. This report estimated YLLs from an age-gender distribution of deaths by the corresponding YLLs for the average age of death in the Standard Life Expectancy Table (West Level 26), with a discount rate of 3.0%.
- Centre for Eye Research Australia and Access Economics (2004) employed a gross VSLY of $162,561 in 2004 dollars, which implicitly included an individual's estimation of other personal costs, including lost earnings and out-of-pocket expenses. The calculated lost wellbeing estimate in 2004 ($6.7 billion) was adjusted downwards to account for this and get the final estimate of $4.8 billion. This report used a *net* VSLY of $161,751 in

2009 (OBPR 2009). Since this was a net value, it was simply multiplied by the number of estimated DALYs in 2009.

As noted, the 2009 lost wellbeing estimate of $9.4 billion applied only to the over 40 age group, while the 2004 estimate of $4.8 billion (Centre for Eye Research Australia and Access Economics 2004) was for the entire population. Accordingly, estimating lost wellbeing for the entire population with vision disorders in 2009 would result in much higher cost.

YLDs from presbyopia were not included in the $9.4 billion lost wellbeing estimate for the reasons outlined in Section 6.2.2.

7 The total cost of vision loss in Australia

7.1 Cost summary

In 2009, the total financial cost of vision loss was estimated to be $7.2 billion, or $12,556 per person with vision loss. Of this total:

- $2.98 billion was estimated health system costs;
- $2.28 billion was estimated productivity losses of those with vision loss;
- $839 million was estimated other indirect costs (aids, modifications, other carer and bring forward of funeral expenses); and
- $869 million was estimated deadweight losses from transfers and lost taxation.
- $251 million was estimated carer (opportunity) costs.

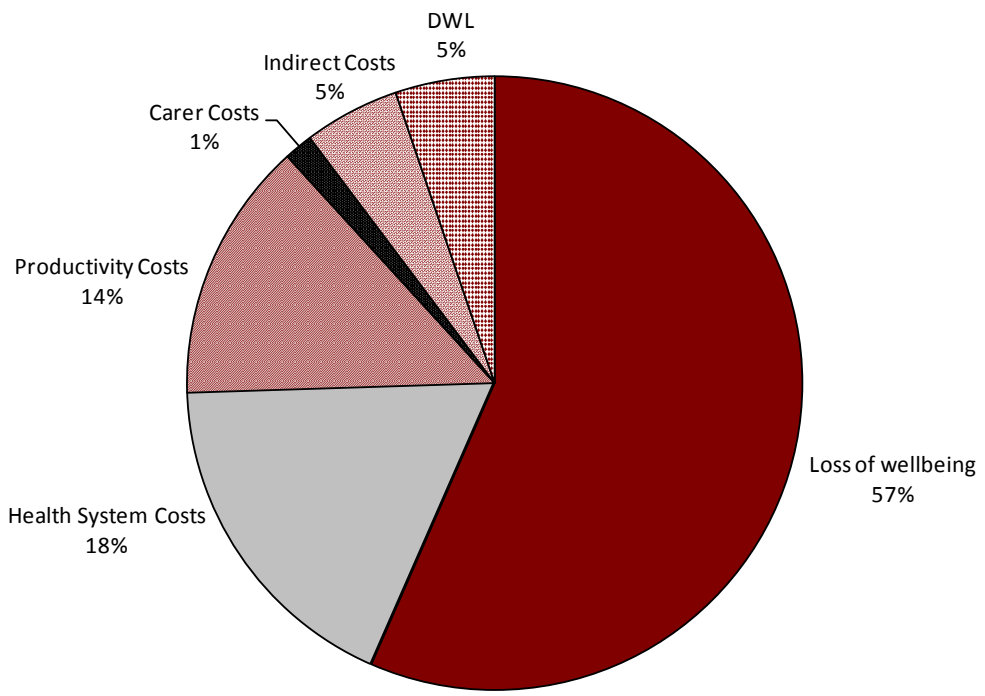
The value of lost wellbeing (disability and premature death), from vision loss was estimated to be $9.4 billion in 2009. Adding this to total financial costs produces an estimate of $16.6 billion as the costs of vision loss in 2009. A cost breakdown is provided in Table 7.38 and Chart 7.13.

Table 7.38: Summary of total cost of vision loss in 2009 by cost type

Cost type	Total cost ($m)
Health system costs (a)	**2,980**
Productivity losses	2,279
Carer opportunity costs	251
Other indirect (aids/modifications/other carer and bring forward of funeral)	839
DWL	869
Total other financial costs (b)	**4,238**
Total financial costs (a) + (b)	**7,218**
Loss of wellbeing (c)	**9,405**
Total economic cost (a) + (b) + (c)	**16,624**

Source: Access Economics calculations

Chart 7.13: Components of total economic cost of vision loss in 2009 (total $16.6 billion)



Source: Access Economics calculations

The estimated economic cost of vision loss in 2009 was approximately $16.6 billion, with the majority (57%) representing the monetary value of the loss of wellbeing. This is equivalent to a cost of $28,917 per person with vision loss in 2009.

7.2 Comparison with previous report

A summary of estimates from this and the previous report (Access Economics, 2004) and commentary is provided in Table 7.39. Estimates from the previous report are presented in Table 7.39 in terms of both 2004 dollars and 2009 dollars, to assist comparisons.

Table 7.39: Comparison with the previous report

Cost type	Centre for Eye Research Australia and Access Economics (2004)	Centre for Eye Research Australia and Access Economics (2004) $2009	This report ($m)	Comment
Health system	1,824	2,046	2,980	Previous report used 2000-01 AIHW data for cataract, RE, glaucoma and AMD. This report used updated 2004-05 AIHW data for cataract, RE, glaucoma and AMD, as well as older data from Centre for Eye Research Australia and Access Economics (2004) for expenditure categories which could not be provided by the AIHW this year. The 'other diseases of the eye and adnexa' category was taken from Centre for Eye Research Australia and Access Economics (2004) and inflated to 2009, as it could not be provided by the AIHW. Spending on Lucentis was added to the AIHW data and cataract expenditure was adjusted up for growth in cataract surgery rates. The 2009 estimate was adjusted to account for unallocated expenditure while the 2004 estimate did not estimate this component.
Productivity losses	1,781	2,015	2,279	Both reports included lost earnings from lower employment and premature death. This report also includes employers' costs of replacing staff.
Carer cost(a)	605	684	251	Methodology in this report based on carer data from ABS SDAC. Previous report based on carer productivity costs from CERA (2003) estimates. Applying the older methodology used in Clear Insight (CERA and Access Economics, 2004) to 2009 would result in estimated carer cost of $819 million. However, the newer methodology based on SDAC data is preferable.
Funeral cost	-	-	0.785	Not estimated in the previous report.

Cost type	Centre for Eye Research Australia and Access Economics (2004)	Centre for Eye Research Australia and Access Economics (2004) $2009	This report ($m)	Comment
Other indirect (b)	611	691	839	Annual mean estimates derived from CERA (2003) and Frisch (2001) were used to estimate aids/modification and other informal carer costs in both reports
DWL	208	235	869	Estimated as being 27.5% per dollar tax revenue raised in last report and 28.75% per dollar in this report (to account for taxation office administration).
Loss of wellbeing	4,818	5,451	9,405	This report includes uncorrected refractive error in YLDs, and estimates YLDs using more granular data by age. Lost wellbeing excluding the category of refractive errors is approximately $5 billion in 2009. The Commonwealth Government estimate of the VSLY was used to quantify lost wellbeing for this report. This is similar to the previous estimate derived by Access Economics. The lost wellbeing estimate in this report is for the over 40 population, while the previous report calculated lost wellbeing for all age groups. Although not included in the total lost wellbeing estimate in 2009, it is noted, as a point of interest, that YLDs from presbyopia amount to approximately $894 million in 2009.
Total cost	**9,847**	**11,123**	**16,624**	**Higher estimate in this report primarily reflects higher estimate for loss of wellbeing.**

(a) Lost carer productivity
(b) Includes cost of aids, modifications and other costs of informal care
Source: Access Economics calculations for this report and Centre for Eye Research Australia and Access Economics (2004)

8 International comparisons

The previous report (Centre for Eye Research Australia and Access Economics 2004) presented comparisons of the Australian cost of vision loss with cost estimates from the United States and the United Kingdom. Updated information is presented below for the cost of vision loss worldwide, and for the United Kingdom, Canada and the US.

A table is provided at the end of this section drawing together the data from different countries and reporting estimates in 2009 Australian dollars. Differences across countries in estimates of the cost of vision loss reflect differences in population age structures (for example, differences in the proportion of the population aged 65 or over), and in the structure of the health and aged care systems (among other factors such as differences in prevalence and risk factors).

8.1 Worldwide

The most recent study of the costs of vision loss and blindness worldwide was released in 2010 (Access Economics 2010). It was estimated that, including vision loss due to uncorrected RE (URE), the worldwide number of people with vision loss (visual acuity of < 6/12) is 733 million in 2010. Of these, the number who are blind (visual acuity of < 6/60) is 156 million. Projections suggest the number of people with vision loss will rise to 929 million in 2020, with 200 million blind in 2020.
If vision loss due to URE is not included, the number of people with vision loss is projected to increase from 347 million in 2010 to 452 million in 2020. The number of blind people is projected to increase from 91 million in 2010 to 119 million in 2020.

The overall prevalence of vision loss in Access Economics (2010) was higher than previously published figures because people with mid vision loss were included (visual acuity worse than 6/12 but greater than or equal to 6/18). Mild vision loss accounts for 42-45% of all vision loss dependent on specific visual acuity definitions (Access Economics 2010). When accounting for this, prevalence numbers in Access Economics (2010) are consistent with the findings of previous studies (Resnikoff et al 2004; Resnikoff et al 2008).

The prevalence of vision loss was calculated by multiplying the prevalence rates (in Table 8.40) by the population in each WHO subregion five-year age group for 2010, 2015 and 2020. In the absence of time-series data the prevalence of vision loss and the distribution of vision loss by cause (excluding URE) are assumed constant to 2020. However, due to forecast population growth, the number of number of people with vision loss is projected to increase over time. This approach is in line with previous global studies for vision loss (Frick and Foster, 2003; Smith et al 2009). Prevalence rates used were derived from Resnikoff et al (2004) and adjusted for differences in visual acuity (VA) definitions and URE (Access Economics 2010).

Table 8.40: Prevalence rates for vision loss (%)

WHO subregion	Blindness (VA < 6/60)			Moderate low vision (6/60 ≤ VA < 6/18)			Mild low vision (6/18 ≤ VA < 6/12)		
	<15 years	15-49 years	50+ years	<15 years	15-49 years	50+ years	<15 years	15-49 years	50+ years
AFR-D	0.30	0.49	21.27	0.43	0.70	25.59	0.58	0.94	34.55
AFR-E	0.30	0.49	21.27	0.43	0.69	25.59	0.58	0.93	34.55
AMR-A	0.38	0.62	2.16	0.83	1.26	4.24	1.13	1.69	5.72
AMR-B	0.33	0.60	5.57	0.64	1.10	9.56	0.86	1.48	12.90
AMR-D	0.34	0.70	8.49	0.67	1.21	12.37	0.90	1.63	16.70
EMR-B	0.31	0.49	13.23	0.57	0.81	16.75	0.76	1.09	22.61
EMR-D	0.31	0.57	15.61	0.56	0.89	19.11	0.75	1.21	25.80
EUR-A	0.38	0.64	2.51	0.84	1.30	4.84	1.14	1.76	6.53
EUR-B1	0.40	0.65	3.34	0.84	1.21	5.16	1.14	1.63	6.96
EUR-B2	0.40	0.64	3.52	0.84	1.18	5.35	1.13	1.60	7.22
EUR-C	0.41	0.69	3.61	0.87	1.30	5.79	1.17	1.75	7.82
SEAR-B	0.37	0.54	12.47	0.70	0.94	14.24	0.94	1.27	19.23
SEAR-D	0.34	0.74	15.40	0.63	1.31	24.40	0.86	1.76	32.94
WPR-A1	0.12	0.28	1.89	0.23	0.42	3.10	0.31	0.57	4.19
WPR-A2	0.12	0.28	1.89	0.23	0.42	3.10	0.31	0.57	4.19
WPR-B1	0.86	1.16	7.63	1.95	2.43	12.20	2.63	3.28	16.46
WPR-B2	0.37	0.54	11.15	0.70	0.93	12.89	0.94	1.26	17.40
WPR-B3	0.41	0.60	6.53	0.79	1.09	9.94	1.07	1.47	13.42

Source: Access Economics (2010).

The distribution of vision loss prevalence by cause, using best-corrected visual acuity only (i.e. excluding vision loss due to URE), is detailed for the year 2002 in Table 8.41[8]. Cataract and glaucoma are the major causes of vision loss in developing regions. In developed regions, particularly AMR-A and EUR-A, AMD and DR contribute greater proportions of all vision loss. This reflects the higher prevalence of diabetes and longer life expectancy in more developed countries.

Table 8.41: Distribution of vision loss based on best-corrected visual acuity by cause (%)

WHO subregion	Cataract	Glaucoma	AMD	Corneal opacities	Diabetic retinopathy	Childhood blindness	Trachoma	Onchocerciasis	Other	Total
AFR-D	50.0	15.0	0.0	8.0	0.0	5.2	6.2	6.0	9.6	100.0
AFR-E	55.0	15.0	0.0	12.0	0.0	5.5	7.4	2.0	3.1	100.0
AMR-A	5.0	18.0	50.0	3.0	17.0	3.1	0.0	0.0	3.9	100.0
AMR-B	40.0	15.0	5.0	5.0	7.0	6.4	0.8	0.0	20.8	100.0

[8] For subregion WPR-A, the proportion of vision loss due to other causes is increased from 5.0% as reported by Resnikoff et al (2004) to 5.1% in order for the proportions to sum to 100%.

AMR-D	58.5	8.0	4.0	3.0	7.0	5.3	0.5	0.0	13.7	100.0
EMR-B	49.0	10.0	3.0	5.5	3.0	4.1	3.2	0.0	22.2	100.0
EMR-D	49.0	11.0	2.0	5.0	3.0	3.2	5.5	0.0	21.3	100.0
EUR-A	5.0	18.0	50.0	3.0	17.0	2.4	0.0	0.0	4.6	100.0
EUR-B1	28.5	15.0	15.0	8.0	15.0	3.5	0.0	0.0	15.0	100.0
EUR-B2	35.5	16.0	15.0	5.0	15.0	6.9	0.0	0.0	6.6	100.0
EUR-C	24.0	20.0	15.0	5.0	15.0	2.4	0.0	0.0	18.6	100.0
SEAR-B	58.0	14.0	3.0	5.0	3.0	2.6	0.0	0.0	14.4	100.0
SEAR-D	51.0	9.0	5.0	3.0	3.0	4.8	1.7	0.0	22.5	100.0
WPR-A1	5.0	18.0	50.0	3.0	17.0	1.9	0.0	0.0	5.1	100.0
WPR-A2	5.0	18.0	50.0	3.0	17.0	1.9	0.0	0.0	5.1	100.0
WPR-B1	48.5	11.0	15.0	3.0	7.0	2.3	6.4	0.0	6.8	100.0
WPR-B2	65.0	6.0	5.0	7.0	3.0	3.6	3.5	0.0	6.9	100.0
WPR-B3	65.0	6.0	3.0	3.0	5.0	9.5	4.3	0.0	4.2	100.0

Source: Resnikoff et al, 2004.

In 2010, the estimated health system costs of vision loss were $US2.3 trillion in 2010, with an expected DWL of $US238 billion, productivity loss of $US168 billion and an estimated informal care burden of $US246 billion. In total the global cost of vision loss was estimated as $US3.0 trillion. The loss of wellbeing is projected to increase over time with population growth (Table 8.42).

Table 8.42: Summary of global results for the burden of disease study in vision loss, ($US)

	2010	2015	2020
Prevalence of vision loss (millions of people)	733	826	929
Direct cost ($US billion)	2,302	2,529	2,767
DWL ($US billion)	238	259	280
Productivity loss ($US billion)	168	175	178
Informal care ($US billion)	246	273	302
DALYs (million)	118	133	150

Source: Access Economics calculations. All costs expressed in 2008 US dollars.

Five strategies were identified to reduce the global burden of vision loss:

1. Coordinate greater screening of high-risk groups including people with diabetes and the elderly; the prevalence of vision loss due to longevity (AMD) and non-communicable chronic diseases is increasing, particularly in developed regions.
2. Provide more training in cataract surgery for doctors working in developing regions; access to cataract surgery is a major barrier to managing sight loss in the developing world.
3. Make corrective eye wear more available and more affordable - over half of all sight loss is caused by uncorrected refractive error, which could easily be reversed using spectacles or contact lenses.
4. Fund and distribute medications to treat river blindness (onchocerciasis) and trachoma in affected populations.

5. Target early treatment of childhood eye diseases, including cataract and glaucoma.

8.2 United Kingdom

In the UK in 2008, 1.8 million people were blind or partially sighted (Table 8.43). The associated economic costs were £22.0 billion in 2008 (Table 8.44). Health care system costs amount to £2.14 billion and other costs were £4.34 billion. In addition, the loss of healthy life and the loss of life due to premature death associated with partial sight and blindness also impose a cost on society through a reduction in the stock of health capital. This reduction was estimated at £15.51 billion in 2008.

Table 8.43: Vision loss in the UK, 2008

	AMD	Cataract	DR	Glaucoma	RE	Other	Total
Males	89,941	75,527	36,511	41,482	371,408	49,190	664,059
Females	209,945	170,035	25,952	53,727	589,350	83,921	1,132,931
Total	299,886	245,562	62,463	95,209	960,758	133,110	1,796,990
%	17%	14%	3%	5%	53%	7%	100%

Source: Access Economics (2009)

Table 8.44: Summary of costs associated with partial sight and blindness in UK adults 2008

	£ million
Health system costs	2,145
Lower employment	1627
Absenteeism	80
Premature mortality	2
Informal care costs	2,030
Devices and modifications	337
Deadweight loss	269
Total – Indirect costs	4,344
Total – Burden of disease costs	15,509
Total –Costs	21,998

Source: Access Economics (2009)

In addition to estimating the economic cost of partial sight and blindness in the UK adult population, four hypothetical eye care interventions were evaluated to estimate their potential cost effectiveness. These focused on four areas identified as most relevant for current UK policy:

- promote the prevention of eye injuries;
- improve access to integrated low vision and rehabilitation services;
- increase regular eye tests for the older population (≥60 years); and
- increase access to eye care services for minority ethnic groups (MEGs).

The results suggested the most effective campaign was that focusing on MEGs because of the lack of access of MEGs to eye care services compared with the population average, and undetected eye conditions in this community are more likely to be severe. It was estimated that an educational campaign using media and an educational road show to ten locations heavily populated with MEGs throughout the UK could result in a cost effectiveness ratio of £1,230 per DALY avoided (90% confidence interval of £1,032 per DALY avoided to £1,559 per DALY avoided).

Results of the other three economic evaluations show there are gains to be made in investing in the promotion of eye care services. In summary the results indicated the following.

- A cost effectiveness ratio of £24,200 per DALY avoided for a campaign that targets older people (≥60 years) to take up regular eye examinations (90% confidence interval of £17,000 per DALY avoided to £41,200 per DALY avoided).
- A cost effectiveness ratio of £100,857 per DALY avoided for a campaign that encourages those with recognised partial sight and blindness to use low vision services (90% confidence interval of £73,900 per DALY avoided to £152,900 per DALY avoided).
- A benefit/cost ratio of 1.62 for a campaign that promotes the use of eye protection to avoid eye injuries (90% confidence interval of 1.32 to 2.25).

8.3 Canada

In 2007, there were an estimated 979,510 Canadians with vision loss (Access Economics 2008a). Cataract was the main source of vision loss. The prevalence of vision loss is projected to double in absolute numbers, an increase from 3.0% in 2008 of the population in 2007 to 5.2% in 2032.

Table 8.45: Prevalence of vision loss, Canada, 2007

	Number	% total
AMD	222,170	22.7%
Cataract	574,747	58.7%
DR	54,906	5.6%
Glaucoma	35,729	3.6%
RE/Other	91,957	9.4%
All vision loss	979,510	100.0%

Source: Access Economics (2008a)

In 2007, the financial cost of vision loss was $CAN12.2 billion. Of this:

- $CAN7.2 billion (59.0%) was direct health system expenditure;
- $CAN2.1 billion (17.6%) was productivity lost due to lower employment, absenteeism and premature death of Australians with vision loss;
- $CAN1.3 billion (10.7%) was the DWL from transfers including welfare payments and taxation forgone;
- $CAN1.2 billion (9.7%) was the value of the care for people with vision loss; and

- $CAN366 million (3.0%) was other indirect costs such as direct program services, aids and home modifications and the bring-forward of funeral costs.

Additionally, the value of the lost wellbeing (disability and premature death) was a further $CAN25.8 billion.

8.4 United States

At least two studies have been released about the cost of vision loss in the US since the release of the original Australian report (Centre for Eye Research Australia and Access Economics 2004).

Rein et al (2006) estimated the societal economic burden, and the governmental budgetary impact of vision loss, blindness, refractive error, age related macular degeneration, cataracts, diabetic retinopathy, and primary open-angle glaucoma among US adults aged 40 years and older. The scope of costs included medical care, the costs of nursing home care attributable to vision loss, government purchase programs, guide dogs for the blind, and productivity losses.

For 2004, the total financial cost of major vision disorders among US residents aged 40 years or older was $US35.4 billion: $US16.2 billion in direct medical costs, $US11.1 billion in other direct costs, and $US8 billion in productivity losses.

Outpatient and pharmaceutical services comprised the majority of direct medical costs, with inpatient costs accounting for virtually no costs. The direct medical costs for each condition were roughly $US6.8 billion for cataracts, $US5.5 billion for refractive error, $US2.9 billion for glaucoma, $US575 million for AMD, and $US493 million for diabetic retinopathy. For people with vision loss aged 40 or over, 75.6% of direct medical costs were attributable to cataracts and refractive error, with another 17.8% attributable to glaucoma.

Among Americans aged 65 years or older, 16% of those who have vision loss and 40% of those who are blind resided in nursing homes, compared with only 4.3% of those in the general population. Around 424,801 more people with low vision and blindness in America reside in nursing homes than would be expected if these same individuals had normal vision. Nursing homes costs were $US11 billion, government purchase programs cost $US94 million and guide dogs cost $US62 million.

Lost productivity annually was $US6.3 billion reflecting an estimated 115,583 people with vision loss and 74,133 blind people who did not work and who would have worked if fully sighted. Rein et al (2006) also estimated that 125,882 people with low vision and 40,671 blind people participated in the labour force but earned less than people with normal vision, with a wage differential of $US9,851 for people with low vision and $US12,121 for the blind. Productivity losses due to decreased earnings were $US1.7 billion. This element of productivity losses is not commonly included in estimates of the cost of vision loss.

In 2004, the total governmental budgetary impact of adult vision disorders was $US13.7 billion (Rein et al 2006).

A study by Frick et al (2007) added value by estimating the value of home care provided by agencies that was not covered by insurers, personal care services paid for by the individual with vision loss or his or her family, and informal care. Medical Expenditure Panel Survey data

from 1996 to 2002 were pooled to estimate the relationship of vision loss and blindness with total medical expenditures, components of expenditures, days of informal care received, and health utility. Statistical analysis accounted for confounders such as comorbidities and demographics. Blindness and vision loss were significantly associated with higher medical care expenditures, a greater number of informal care days, and a decrease in health utility (measured in terms of quality adjusted life years (QALYs) — although the sample for health utility estimates was relatively small).

Individuals with blindness had significantly higher odds of positive home health care expenditures (odds ratio, 2.1; 95% confidence interval, 1.6-2.8). Individuals with blindness who used home health agencies had expenditures that were $US4,900 more than those for individuals without vision loss who had home health agency expenditures (P=.005). Individuals with blindness who used private home health providers had expenditures that were $US1,200 more than those for individuals without vision loss who used private home health providers (although not statistically significantly [P=.60]).

Interestingly, individuals with blindness who were admitted for inpatient care had lower expenditures than individuals without vision loss who were admitted for inpatient care. Frick et al (2007) suggested this reflected that individuals with blindness may be admitted for less serious conditions for which they do not have sufficient care to remain in the home, resulting in a lower average expenditure per admission.

Frick et al (2007) concluded that excess expenditures (including medical and home care) for those who had low vision or blindness were $US5.1 billion, primarily owing to home care. The total value of informal care (based on an additional 5.2 days per year for a blind person and 1.2 days for a person with low vision) was $US0.4 billion. The total monetary cost was therefore $US5.5 billion. While the impact on QALYs lost (0.07 per blind person and 0.05 per person with vision loss) were lower than for other studies, Frick et al (2007) cited potential differences in short and long term impacts of losing vision as those affected adapt over time, and suggested the need for further research.

8.5 Summary

A summary of the international comparisons together with a conversion of key international estimates of costs into Australian dollars (2009) is provided in Table 8.46. The currency conversions are based on Organisation for Economic Cooperation and Development (OECD) purchasing power parity statistics[9]. As mentioned above, differences across countries in estimates of the cost of vision loss reflect differences in population age structures (for example, differences in the proportion of the population aged 65 or over), differences in prevalence and risk factors and differences in the structure of the health and aged care systems. Differences across studies can reflect different methodologies.

[9] OECD purchasing power parity statistics, 23 Apr 2010

Table 8.46: International comparison summary table

	Worldwide	UK	Canada	US Rein et al (2006)	US Frick et al (2007)	Australia (this report)
Year for the estimates	2010	2008	2007	2004	2004	2009
Prevalence (people)	733 million	1.8 million	979,510	Not estimated for this study.	Not estimated for this study.	575,000
Costs expressed in	2008 US dollars	2008 UK pounds	2007 Canadian dollars	2004 US dollars	2004 US dollars	2009 Australian dollars
Health system cost	$2,302 billion	£2.14 billion	$7.2 billion	$16.2 billion	Not reported	
2009 Australian dollar equivalent	$2,952 billion	$5.04 billion	$8.59 billion	$20.8 billion		$2.9 billion
Productivity loss	$168 billion	£1,708.93 million	$2.1 billion	$8 billion	Not reported	
2009 Australian dollar equivalent	$215 billion	$4.0 billion	$2.51 billion	$10.3 billion		$2.3 billion
Other	Informal care $246 billion	Informal care £2,029.70 million		Nursing homes $11 billion, Government purchase programs $94 million Guide dogs $US62 million.	Home care $US5.5 billion	
2009 Australian dollar equivalent	$315 billion	$4,784.23 million		Nursing homes $14.1 million Government purchase programs $120.5 million Guide dogs $79.5 million	$7.1 billion	Informal care $251 million Other indirect $839 million deadweight losses $868 million
Comments				Major vision disorders		

9 Eliminating avoidable blindness in the current environment of health system reform

The analysis in this report has found that, in Australia in 2009, there were almost 575,000 Australians aged 40 or over with vision loss. This equates to 5.8% of the Australian population in that age group. Of these around 66,500 people were blind. In addition to this, it was estimated that there were approximately 73,000 people with presbyopia in 2009. It is projected that the number of people aged 40 or over with vision loss will rise to almost 801,000 by 2020 and those who are blind will rise to 102,750. Those with presbyopia are projected to rise to almost 90,000 by 2020.

In 2009, the total economic cost of vision loss (including loss of wellbeing) was estimated to be $16.6 billion in 2009, or $28,917 per person with vision loss aged 40 and over. The total financial cost component was estimated to be $7.2 billion, or $12,556 per person with vision loss. The component of health system costs that can be allocated to specific diseases are alone projected to rise from $2,580 million in 2009 to $4,766 million by 2020.

Most cases of vision loss and blindness are avoidable, through evidence based, effective interventions across the spectrum from prevention, early intervention, and treatment. Moreover, quality of life and independence can be improved through rehabilitation, aids and equipment which enhance vision and improve functionality of those with low vision.

Many Australians are needlessly experiencing vision loss. Improving awareness about how to avoid vision loss, and ensuring access to eye care services, including prevention, treatment and rehabilitation services, are important.

Vision 2020 and eliminating avoidable blindness

VISION 2020: The Right to Sight is a collaborative effort between WHO and a number of partners (governmental and nongovernmental organisations, professional bodies and institutions). It has as its goal the elimination of avoidable blindness by the year 2020.

The WHO estimated that 75% of world blindness was avoidable with cost effective intervention strategies (WHO 2005). In 2000, of 45 million people who were blind, 60% were blind due to cataract and refractive error (treatable), 15% of blindness was due to trachoma, vitamin A deficiency and onchocerciasis (preventable); another 15% of blindness was due to DR and glaucoma (partly preventable although difficult, or treatment can slow progress of disease) and the other 10% was attributable to AMD and other diseases (progress can be slowed in some cases but more research needed) (WHO 2005).

The newer estimates by Access Economics (2010) drawing on more recent data from Resnikoff et al, (2004) and Resnikoff et al, (2008) suggest close to 75% of world blindness in 2010 was due to cataract and URE alone implying an even higher proportion of avoidable blindness. Worldwide vision loss by cause is in Table 9.47 — noting that the proportion by cause drawn from the literature was the same for all vision loss and for blindness.

Table 9.47: Number of people in the world with vision loss, 2010

	Number people	% by cause
Cataract	160,219	22%
Glaucoma	43,076	6%
AMD	32,878	4%
Corneal opacities	17,354	2%
Diabetic retinopathy	18,172	2%
Childhood blindness	13,867	2%
Trachoma	12,299	2%
Onchocerciasis	2,396	0%
Other	46,859	6%
Uncorrected refractive error	385,702	53%
Total	732,822	100%

Source: Access Economics (2010)

In Australia, according to the analysis in this report, most vision loss is caused by uncorrected refractive error, cataract, age-related macular degeneration, glaucoma and diabetic retinopathy. A high proportion of vision loss from these causes is avoidable through cost effective interventions. A list of cost effective interventions was provided in the previous report (Centre for Eye Research Australia and Access Economics 2004). A key example is cataract surgery which has been comprehensively shown – across many studies – to be highly cost effective (see the box below). Cataract caused 15% of vision loss in 2009 in Australia. Insertion of an intraocular lens results in almost immediate vision restoration.

Cost effectiveness of cataract surgery

The outcome metric used in cost utility analysis is quality adjusted life years (QALYs) gained or disability adjusted life years (DALYs) averted. The WHO (2002) defines cost effectiveness relative to gross domestic product (GDP) per capita as:

cost effective: one to three times GDP per capita to avert one lost DALY (for Australia in 2009, around A$50,000 to A$150,000 per DALY averted); and

very cost effective: less than GDP per capita to avert one lost DALY (for Australia in 2009, less than A$50,000/DALY averted).

Other cost effectiveness benchmarks include DoHA (2003) of $60,000/QALY or the Australian Government Value of a Statistical Life Year (VLSY) benchmark of $151,000 (mentioned above in chapter 6). Various studies have found cataract surgery cost effective when measured against these benchmarks.

In the United States, first eye cataract surgery cost $US2,020 per QALY and second eye cataract surgery was almost as cost effective at $US2,727 (Busbee 2002; Busbee 2003).

In Sweden, Kobelt et al (2002) estimated the cost utility of cataract surgery was $US4,800/QALY.

In a unique study that evaluated the cost effectiveness of intra-capsular and extra-capsular cataract surgery, Baltussen et al (2004) used varying proportions of coverage (50%, 80% and 95%) and a 3% discount rate to find globally that intra- and extra-capsular cataract surgeries are cost effective. They found that providing extra-capsular cataract surgery to 95% of those who need worldwide would avert over 3.5 million DALYs per annum.

Lansingh (2006) found that cost utility values for cataract surgery (first eye) varied from $245 to $22,000/QALY in Western countries and from $9 to $1,600 in developing countries. In the Western world cataract surgery is generally more cost effective than either epileptic surgery or defibrillator implantation, and with a substantially more cost effective lower bound than knee arthroplasty.

Other eye health interventions which comprise standard care in Australia include:

- Glasses or surgery for refractive error.
- Pharmaceuticals and/or laser therapy for primary open angle glaucoma. The Ocular Hypertension Treatment Study and the Early Manifest Glaucoma Trial showed that the rate of progression of primary open angle glaucoma can be delayed by half with these interventions. Detection and early intervention is important because once vision has been lost it cannot be restored.
- Diabetic retinopathy can be prevented through prevention or control of diabetes. In particular, control of blood lipids (Keech et al, 2007), blood pressure (Mohamed et al, 2007) and glycaemic control (Diabetes Control and Complications Trial 1993; United

Kingdom Prospective Diabetes Study 2004 and 1998) are effective in reducing the risk of DR among people with diabetes.

- Regular eye examinations for people with diabetes to detect early diabetic retinopathy, — two yearly for the general population and annually for those at higher risk such as Aboriginal and Torres Strait Islander Australians (NHMRC 2008) — and appropriately timed laser treatment can prevent 90% of severe vision loss (Ferris 1993).
- Age related macular degeneration of the wet form can be treated to preserve vision. Tobacco smoking is a risk factor for AMD, and a reduction in AMD is one of the potential benefits of reducing Australian smoking rates. The pharmaceuticals such as Lucentis and anti-VEGF treatments slow the progress of wet AMD and in a number of cases restore some vision.
- Vision loss among Indigenous Australians due to trachoma can be prevented through surgery, antibiotics and improved sanitation. Trachoma is caused by bacteria and transmission occurs in overcrowded communities with inadequate access to water and sanitation (WHO 2005). The Australian Government initiative '*Improving Eye and Ear Health Services for Indigenous Australians for Better Education and Employment*' includes a number of programs to improve Aboriginal and Torres Strait Islander eye health, including funding for prevention and control of trachoma.

Australia has joined the VISION 2020 collaboration and in 2005 the Australian Health Ministers' Conference endorsed the *National Framework for Action to Promote Eye Health and Prevent Avoidable Blindness and Vision Loss* (National Framework), with five key areas for action:

- reducing the risk of eye disease and injury;
- increasing early detection;
- improving access to eye health care services;
- improving the systems and quality of care; and
- improving the underlying evidence base.

9.2 Health reform

9.2.1 The need for coordination, cooperation and collaboration in vision related policy

Various documents explaining reforms to the Australian health system specify significant changes in funding responsibilities (Australian Government 2010, Australian Government 2010a, Australian Government 2010b, Australian Government 2010c). Notably:

- The Commonwealth Government will become the majority funder of Australian public hospitals. The Commonwealth will fund 60 per cent of the efficient price for all public hospital services, and 60 per cent of capital, research and training in our public hospitals.
- The Commonwealth will also take full funding and policy responsibility for GP and primary health care services. This covers services currently provided by states and territories, including community health centre primary health care services, primary mental health care, immunisation and cancer screening programs, as well as any further services to be agreed with the states and territories for recommendation to the Council of Australian Governments (COAG) by December 2010.

- The Commonwealth will fund all aged care services, including home and community care (HACC) (subject to negotiations with some states).
- The States will be responsible for funding care services for younger people – such as younger people with disabilities – wherever they are receiving care.

Cooperation, collaboration and coordination will remain a key issue for the health system, as well as for government agencies more broadly.

There is a danger that health, disability and aged care policies and programs will continue to operate as silos. Programs that benefit all three sectors may be undervalued by each and thus underfunded. Rehabilitation programs are a prime example. While often a cost to the health system, the benefits potentially flow to disability and ageing budgets as well (for example, improving independence, and reducing rates of admission to residential aged care). Vision aids are another example. By improving functionality and independence, these may reduce rates of falls (potentially a health system cost) and admissions to residential aged care. Government assessments for subsidies and funding of programs need to incorporate benefits to society and not just to the health system budget (or disability or aged care budget) alone.

The Productivity Commission alluded to the problems associated with fragmented funding systems in its Issues Paper (Productivity Commission 2010). The Australian Government has asked the Productivity Commission to undertake a public inquiry into a long-term disability care and support scheme. The Inquiry Terms of reference includes (amongst other things): how a scheme should be designed and funded to better meet the long-term needs of people with disability, their families and carers and how the scheme will interact with the health, aged care, informal care, income support and injury insurance systems. The findings of this Inquiry will be of vital importance to those with vision loss.

The silos problem can be a considerable challenge for people with vision loss who — in addition to needing health, disability and aged care services — may need education, housing, employment and transport services. Lack of coordination and cooperation can have adverse outcomes for people with vision loss. As an illustration, intensive educational assistance early in life can broaden the career options available to those with vision loss and enable them to achieve independence. Lack of access to special assistance at school may mean greater use of disability, housing, employment and aged care services later in life.

Within the health sector, there is a great deal riding on the ability of Medicare Locals, GP Super Clinics, local hospital networks and other primary care organisations to communicate and establish strong links among themselves and with their local communities, as well as ensuring evidence based care is provided. It remains to be seen whether these services will be able to cooperate and collaborate to improve continuity of care – in particular providing integrated and streamlined services for people with low vision.

Matching epidemiological information with service utilisation data will be important, but will not emerge in the short term. Tracking whether access to health services has improved for people with low vision will be an important challenge. The e-health initiatives are to be welcomed if they facilitate coordination and continuity of care, while also expanding the platform for research on access to and utilisation of health and disability services. Accurate data can provide valuable information and can also be used proactively in the prevention of eye related diseases, especially when overlayed with demographic information.

9.2.2 The evidence base, evaluation and reporting

Objective three of the 2009 World Health Organisation 62nd World Health Assembly (WHO 62nd WHA) (which Australia has signed up to) is to Increase and expand research for the prevention of blindness and visual impairment. More specifically,

> *Public-health action to prevent blindness and visual impairment needs to be evidence-based and cost-effective. International collaboration in promoting multidimensional and multisectoral research is essential for developing eye-care systems that are comprehensive, integrated, equitable, high-quality and sustainable. Further research is needed on ways to capitalize on available evidence. Special emphasis should be placed on evaluating interventions and different strategies for early detection and screening of the causes of blindness and visual impairment in different population groups (WHO 62nd WHA:12).*

Ongoing high quality epidemiological, clinical, economic, health services and evaluation research is required to underpin eye health policy and practice (Australian Health Ministers' Conference 2005). Enhanced understanding of the aetiology of eye health problems and better prevention and detection methods, early intervention and treatment options is required. Basic and applied scientific and medical research on ways to improve eye health and functionality are important — including the preventive and public health streams identified as part of the health reforms.

The recommendations for improving the evidence base endorsed by the Australian Health Ministers' Conference (2005) remain relevant. In particular, Health Ministers recommended:

- identify eye health research gaps and national priorities in consultation with all key stakeholders;
- promote inclusion of eye research on other public health and social policy research agendas;
- develop a strategic and nationally consistent approach to eye health data collection;
- improve the utility of existing health data collections in regard to eye health;
- examine existing health datasets for relevance to eye health and explore opportunities to influence the development of health data systems in order to enhance their relevance to eye health;
- integrate and link existing databases to improve health monitoring, examination of successful outcomes and health care utilisation.

Research dedicated to Indigenous eye health is imperative as Aboriginal and Torres Strait Islander Australians experience higher rates of eye disease, and different types of eye disease to those of other Australians. **Blindness rates in Indigenous adults are six times the rate in mainstream populations and 94% of the vision loss among Aboriginal and Torres Strait Islanders is preventable or treatable (Taylor and Stanford 2010).** In addition, the set of interventions that suit non-Indigenous Australians can differ to interventions appropriate for Aboriginal and Torres Strait Islanders. Notably, 35% of Indigenous adults have never had an eye exam (Taylor and Stanford 2010).

The National Eye Health Initiative (NEHI) — announced in the 2006-07 Commonwealth Budget in response to the release of the *National Framework for Action to Promote Eye Health and Prevent Avoidable Blindness and Vision Loss* by Health Ministers in 2005 funded a range of demonstration projects to contribute to a sound evidence base on which to build further activity. These projects provide a useful base on which to build further activity.

Evaluation and monitoring

It is still not possible with current data sets available to gauge Australia's success in reducing avoidable blindness. This needs to be rectified, consistent with the objective of the WHO 62nd WHA:

> *Monitor progress in elimination of avoidable blindness at national, regional and global levels (WHO 62nd WHA 2009:14).*

In more detail, the WHO 62nd WHA (2009:14) advocated collection of

> *Information on causes, the magnitude and geographical distribution of blindness and visual impairment, together with their trends, is essential for evidence-based advocacy and planning. Likewise, understanding the constraints and gaps in current service delivery and monitoring how these are corrected by Member States are crucial to successful implementation. Necessary and timely adjustments can only be made on the basis of continuous monitoring and periodic evaluation of action to prevent blindness.*

Member states (including Australia) agreed to:

- Provision of regularly updated data and information on prevalence and causes of blindness and visual impairment, disaggregated by age, gender and socioeconomic status; and
- Strengthening standardised data collection and establishing surveillance systems using existing WHO tools (WHO 62nd WHA).

Evaluation and research on the success or otherwise of policies and programs is an important component of the research agenda. Health services research is an area which has been traditionally neglected. In accordance with the National Framework (Australian Health Ministers' Conference 2005), further health services research is required to identify barriers to access and strategies to improve access to eye health care. Integration and linkage of existing databases will substantially promote our ability to monitor health and analyse services and their contribution to health outcomes.

Analysis of the effectiveness and cost effectiveness of services and programs for Australians with vision loss is a key gap that needs to be addressed. The Australian Government recently recommended that the goal of Commonwealth health technology assessment processes at the highest level should be that:

> *Australians have timely, equitable and affordable access to the cost-effective health technologies needed to manage their health (Australian Government Department of Health and Ageing 2009:7).*

To this, we should add that Australians have timely, equitable and affordable access to the cost-effective technologies needed to manage their disability.

The recommendation in the National Framework (Australian Health Ministers' Conference 2005) to develop performance indicators for the achievement of each key action area has not been implemented.

The heightened emphasis on transparency and reporting of outputs and outcomes as part of the health reform initiatives is welcomed. This should also be matched in the disability services sector.

The AIHW, and the Steering Committee for the Review of Government Service Provision (SCRGSP) publish performance indicators for Australian health and social services. A publication focusing on achieving avoidable blindness with an appropriate indicator framework would be a valuable addition to these types of reports. Development of indicator frameworks can also identify gaps in information and assist in planning research needs.

ABS health and disability surveys

A new, expanded health survey will be conducted in 2011 by the Australian Bureau of Statistics. Previous health surveys reported on the number of Australians with diseases of the eye and adnexa as a long term health condition (with sub-reporting for cataract, glaucoma, astigmatism, macular degeneration, presbyopia, short sightedness, long sightedness, other disorders of the ocular muscles, accommodation and refraction, blindness (complete/partial), other vision disturbances or loss of vision, other diseases of he eye and adnexa). The current survey could be improved by asking whether refractive error is corrected in an easily understood question, determining the extent of blindness (for example, defining complete and partial). However, these improvements would not improve its usefulness as an epidemiological indicator because the estimates are based on self reported conditions and not clinically confirmed.

In the absence of funding to update the MVIP and BMES, population surveys undertaken with the express aim of estimating the prevalence of eye conditions and vision loss would be useful. A voluntary pathology survey will be conducted as part of the Australian Health Survey. It would be worth considering the addition of eye tests as a complement to the pathology survey.

Sample sizes from the ABS SDAC are commonly too small to allow a depth of analysis about people with a particular type of disability and those who care for them. Expanding the sample size for the SDAC to ensure useful sample sizes of those with low vision would also substantially improve our knowledge of the prevalence of people who are disabled as a result of low vision, and also our understanding of their care arrangements.

9.2.3 The focus on prevention

The initial focus of prevention policy and the National Preventive Health Agency is prevention of tobacco smoking, alcohol and obesity. These are risk factors for vision loss and cost effective interventions to reduce their prevalence will improve vision outcomes for many Australians.

By elevating vision health as a public health issue (to the same level as smoking cessation or diabetes), people could become better informed about vision loss and take significant steps to reduce their risk. Eye health messages need to be included in all prevention campaigns, with messages targeted at 'at risk' populations, for example, Aboriginal and Torres Strait Islander Australians. Awareness campaigns about tobacco, alcohol and obesity need to incorporate messages about their danger to eye health. The National Framework provides a list of recommendations about integration of prevention activities (Australian Health Ministers' Conference 2005), for example, linkages to skin cancer prevention communication activities at national, state and local levels to promote the importance of avoiding exposure to high levels of ultraviolet light and glare to avoid possible vision loss

Medicare Locals, local hospital networks and other primary health care organisations will be important elements in the delivery and dissemination of preventive health messages and in promoting eye health. Medicare Locals and local hospital networks will also be important in collecting evidence among local communities for targeting prevention services and tailoring prevention to individual communities. Networks and linkages between these local organisations and the National Preventive Health Agency will be important.

Promotion and prevention strategies need to be integrated and education of GPs, nurses and allied care professionals is an important complement to social marketing campaigns aimed at educating consumers. The primary health care workforce needs to be able to identify vision loss, detect eye disease and refer appropriately

Moreover, educating providers of services to older Australians (HACC, Community Aged Care Packages, Extended Aged Care at Home, and Aged Care Assessment Teams) on avoidable vision loss may also prove useful. They are regularly in contact with older people and may notice some loss of function in their clients because of vision loss. They may be able to assist in encouraging their clients to seek treatment or access services which can improve their vision and thus their ability to function independently.

Since 2002, Vision 2020 Australia has been funded by the Victorian Government to implement the Vision Initiative which is a major part of the government's public health response to the National Framework for Action to Promote Eye Health and Prevent Avoidable Blindness and Vision Loss (National Framework). The Vision Initiative program works in partnership to raise awareness of eye health and vision care to the general community and to health care professionals. The key objectives are to:

- increase the awareness and knowledge of target population groups about the importance of preventative activity and regular eye examinations
- improve the understanding and awareness of health and community professionals of eye health and vision issues and referral pathways
- ensure a platform for collaboration and sustainable partnerships between Victorian eye health and vision care providers, government and other organisations.

Other state and territories could build a similar model, following an audit of evidence based interventions in each jurisdiction.

9.2.4 Regular eye health tests

Regular eye health tests are important. Medicare covers the cost of an eye examination with an optometrist. Regular eye examinations are required for early detection of RE and eye disease and will reduce vision loss from cataract AMD, diabetes and glaucoma.

Eye health tests need to be explicitly incorporated into the range of Medicare Benefits Schedule health checks (including those for children, people aged 45-49 at risk of developing chronic disease, Indigenous Australians and older Australians aged 75 years or more).

Access to and utilisation of eye care services, including prevention, treatment and rehabilitation services, is important in eliminating avoidable vision loss.

9.2.5 Reforming care for those with diabetes

Consistent with the National Framework (Australian Health Ministers' Conference 2005), care of eye health needs to be integrated into primary health care chronic disease management programs. The first chronic disease to be highlighted as part of the health reforms is diabetes.

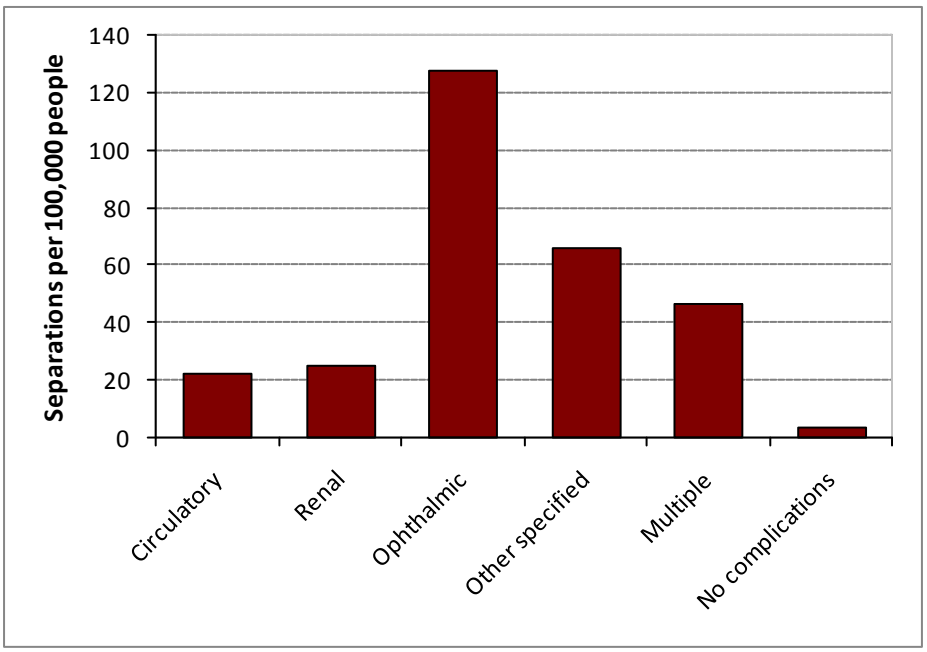
As part of the health reforms, patients diagnosed with diabetes will have the option to enrol with a general practice of their choice to receive coordinated care, and access a range of additional services. As implied elsewhere in this report, eye tests are a vital aspect of care for people with diabetes.

In 2008-09, 19.8% of people with diabetes received an annual cycle of care from a GP[10] (in all States and Territories except the NT) (SCRGSP 2010). The annual cycle of care comprises the components of care, delivered over the course of a year, that are minimum requirements for the appropriate management of diabetes in general practice. These data raise questions about the proportion of people with diabetes who currently receive a regular eye exam. Hospitalisations for ophthalmic complications of type 2 diabetes are more common than hospitalisations for other complications (Chart 9.14).

All people with diabetes mellitus – both type 1 and type 2 – need to have a comprehensive dilated eye exam at the time of diagnosis and at least once every two years thereafter — once every year for Indigenous people (NHMRC 2008). Retinal photography needs to be encouraged. Use of retinal photography means it is easier to educate health professionals to achieve more effective diagnosis and it is very cost effective, saving $33.24 in the cost of each screen relative to more traditional diagnostic methods (Access Economics 2005a).

[10] Since 2001, rebates have been available to GPs under the Medicare Benefits Schedule (MBS) on completion of an annual cycle of care for diabetes. The 'required annual cycle of care' is generally based on the Royal Australian College of General Practitioners' clinical guidelines for the management of Type 2 diabetes in general practice (but requires less frequent testing of glycosolated haemoglobin). Clinical guidelines represent the minimum required level of care. The need for a standard definition of 'annual cycle of care' has been identified (SCRGSP 2010).

Chart 9.14: Separations for type 2 diabetes mellitus as principal diagnosis by complication, 2007-08



Source: SCRGSP (2010)

9.2.6 Elective surgery

As noted above, cataract surgery is highly cost effective in restoring sight. Yet public hospital elective surgery waiting times for ophthalmology procedures have traditionally been worse than average (Chart 9.15). The right hand corner of Chart 9.15 shows that waiting times for cataract surgery in particular, are worse than average. Ophthalmology waiting times are not reported by urgency category,[11] so it is not possible to judge whether patients wait longer than is recommended for ophthalmology care.

The National Framework (Australian Health Ministers' Conference 2005) recommended (among other things):

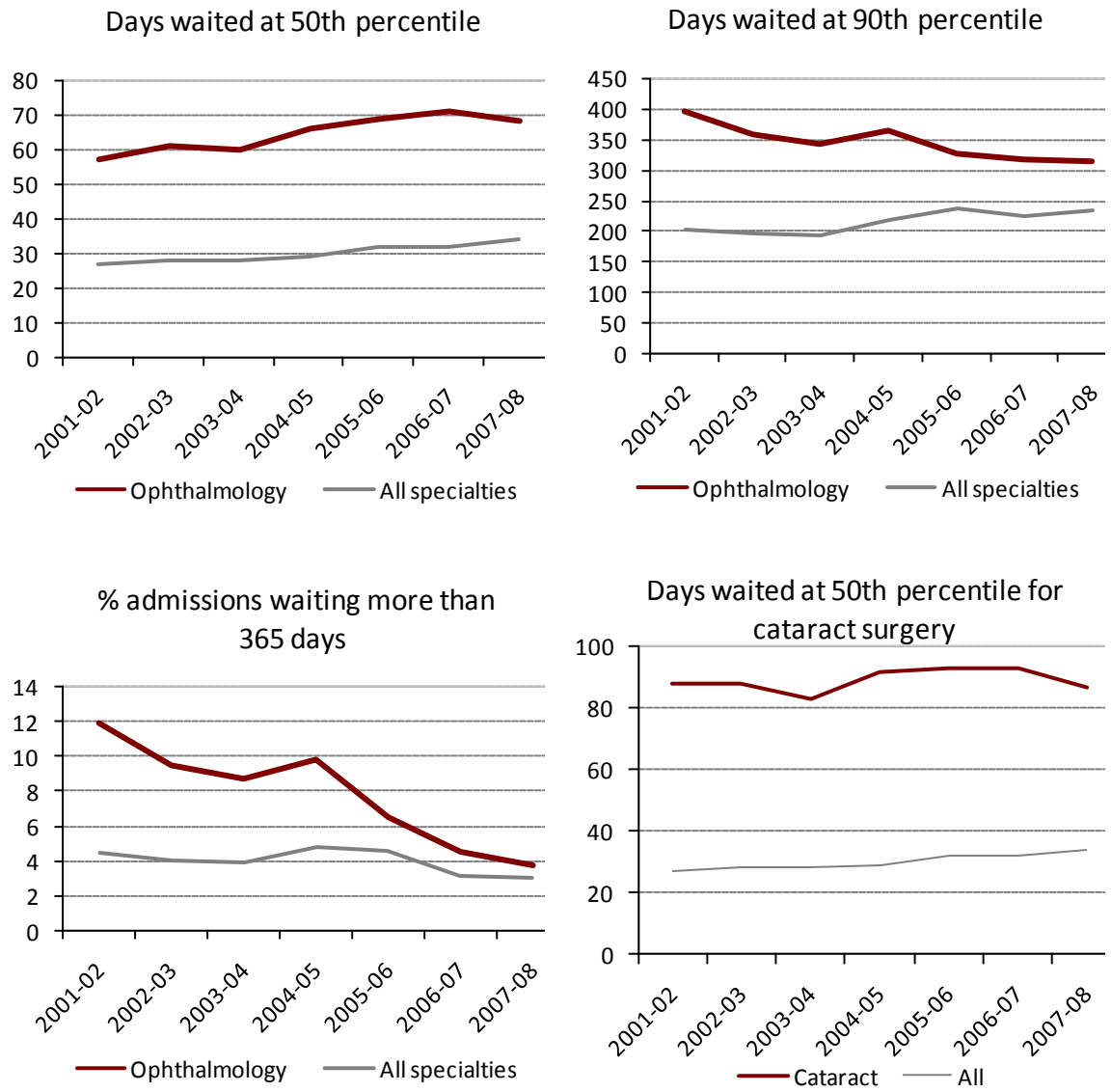
- implement waiting list management strategies to reduce waiting times for cataract surgery; and
- monitor access to public hospital elective surgery to inform hospital eye health performance information and eye surgery service planning.

As part of the health system reforms, $650 million will be allocated over four years to achieving a target of 95% of elective surgeries within clinically recommended times.

[11] A clinical assessment of the urgency with which a patient requires elective hospital care. For example, category 1 = admission within 30 days desirable for a condition that has the potential to deteriorate quickly to the point that it may become an emergency whereas category 2=admission within 90 days desirable for a condition causing some pain, dysfunction or disability but which is not likely to deteriorate quickly or become an emergency and category 3=admission at some time in the future acceptable for a condition causing minimal or no pain, dysfunction or disability, which is unlikely to deteriorate quickly and which does not have the potential to become an emergency (AIHW National Health Data Dictionary Version 14, accessed May 2010).

Waiting list management and monitoring are still required to ensure patients do not wait unnecessarily long for cataract surgery. In addition, ophthalmology and procedural waiting lists need to be publicly reported by urgency category.

Chart 9.15: Elective surgery waiting times by specialty of surgeon(a)



(a) Data for 565,501 admissions in 2007-08 of which ophthalmology admissions accounted for 65,339, and admissions for cataract extraction represented 47,914.

Source: AIHW (2009a)

9.2.7 Health workforce

Both the NHHRC report to the Australian Government and the National Primary Health Care Strategy noted overall shortages across a range of the nursing, medical and allied health professions and the maldistribution of the health workforce across metropolitan and rural areas. The Government announced investments to train more doctors and allied health

professionals including GPs, specialist doctors, clinical training scholarships for allied health and a rural locum scheme.

While optometrists and ophthalmologists were not specifically mentioned in these reports, ophthalmologists were mentioned by the National Health Workforce Taskforce (2009). In that report, among broader constraints identified as restricting the opportunities for training clinicians, the heavy reliance on the public sector for specialist and clinical training was identified as a problem for a variety of conditions now managed predominantly in the private sector — ophthalmic conditions among them. As the AIHW (2009c) report, there was a decline in the number of ophthalmologists working some hours in the public sector between 2001 and 2006 and an increase in those working in the private sector. Addressing constraints on training, including in both the public and the private sector, is very important. Clearly, to sustain the ophthalmologist workforce, there is a need for trainers who provide training services in private practices.

Workforce quality and sustainability is obviously a key factor in eye care as for other aspects of health.

In 1996, the size of the practising ophthalmology workforce was estimated to be 675 (Australian Medical Workforce Advisory Committee, AMWAC 1996).[12] AMWAC concluded there was a maldistribution of ophthalmologists, with a particular shortage in Qld and WA. It was recommended that, to balance supply with the estimated growth in requirements, 1.6% per year growth in graduate output would be required with a target of 32 by 2006. The AIHW (2009c) reported 16 new ophthalmology fellows in 2006.

In 2007, there were 828 ophthalmology clinicians and 843 ophthalmologists (AIHW 2009b). This suggests 1.9% per annum growth in clinical ophthalmologists. The number of ophthalmologists per Australian has remained relatively constant since 1996. It is not clear whether there are sufficient ophthalmologists to eliminate avoidable blindness by 2020. However, it is likely that the supply of ophthalmologists — like other health workforces — will be affected by the increasing desire for work-life balance and part time work, particularly as the proportion of females in the ophthalmology workforce rises.

Table 9.48: Ratio of clinical ophthalmologists to population (per 100,000 people)

	1996	2007
Total population	3.7	3.9
Population aged 65 or over	30.6	30.0

Source: AMWAC 1996 and AIHW 2009a

Optometrists provide 75% of primary eye care in Australia (AIHW 2010[13]). In 2008-09, optometrists provided over 3 million consultations.[14] The AIHW (2009c) show that for 2006,

[12] The Working Party defined an ophthalmologist as: A qualified surgeon who is conducting ophthalmology consultations, ophthalmology surgery, medico-legal consultations on ophthalmology or is in a full time or part time academic position relating to this specialty. It will include salaried positions and private practice. It does not include other practitioners who, for one reason or another, undertake ophthalmology work as part of their practice; nor does it include the training registrars who hold positions in hospitals or the service registrars who work in ophthalmology but are not recognised as being in training positions.

[13] http://www.aihw.gov.au/eyehealth/overview.cfm

compared with 18 optometrists per 100,000 people in major cities, there were 10 full-time equivalent (FTE) optometrists per 100,000 people in outer regional areas and three per 100,000 in remote or very remote areas. Access Economics (2006) also noted the maldistribution of the optometrist workforce across urban and regional areas.

Taylor and Stanford (2010) reported a marked shortage of optometric and ophthalmic services in more remote areas, and up to 24% less service provision in very remote areas. The relative number of both ophthalmologists and optometrists was lower in areas with more Indigenous Australians, with part of this difference being attributable to remoteness and overall socioeconomic disadvantage. A case study of nine of the twelve outreach services to remote areas of Australia found (Taylor and Stanford 2010) that:

- The supply of ophthalmologists and optometrists varied greatly but was up to 19 times lower than the national average;
- The number of cataract operations also varied greatly, with every region below the national average, and one region being ten times less than the national average; and
- Six services were below the minimum threshold set by WHO for Africa to eliminate blindness.

Outreach programs (such as the expanded Visiting Optometrist Scheme which is part of the Australian Government initiative '*Improving Eye and Ear health Services for Indigenous Australians for Better Education and Employment*') are targeted at alleviating this maldistribution to identified areas of need, principally in remote and very remote Aboriginal communities.

Workforce studies conducted by the Optometrists Association Australia (Kiely et al 2008) suggest that the number of optometrists is adequate for the foreseeable future. More recent workforce data suggest that the approximately 3,800 optometrists in practice in July 2009 have significant unused clinical capacity and are a resource of which more use could be made. Optometrist Association studies show that an average full time optometrist spent 22.2 hours out of a 37.5 hour working week (59.6 per cent) on clinical activities where these were defined as being Medicare and Veterans Affairs consultations and administration relating to those consultations. The remaining 40.4 per cent of the working week is typically spent on non-clinical activities such as practice management. While the study by Kiely et al (2008) suggests that current optometric workforce can meet current demand in almost all parts of Australia and there is over-supply of optometrists in some capital cities, since that study was released, an additional optometry school has commenced at Flinders University in Adelaide which expects to graduate between 30 – 40 optometrists a year by 2014.

Additional workforce studies conducted by the Optometrists Association have looked at the supply of optometrists in local government areas (LGAs). Kiely et al (2007) showed that while there are substantial variations in the distribution of optometrists across LGAs in Australia, the variation is often a poor indicator of the ease with which people can access optometric services. In metropolitan areas, people may live close to an optometric practice in a neighbouring LGA. In rural areas, an LGA may appear to have an adequate number of optometrists but some residents may be several hours from the nearest optometrist or the optometric service is provided on a part-time basis.

[14] Medicare Australia statistics, MBS item number 10900, www.medicareaustralia.gov.au accessed June 2010.

Workforce analysis and research

The eye health workforce is not restricted to ophthalmologists and optometrists but includes GPs, ophthalmic nurses, orthoptists, optical dispensers and optical technicians.

Rehabilitation workers, occupational therapists, orientation and mobility specialists, and employment consultants are also important in assisting people with vision loss to achieve independence and quality of life — but it is not clear whether these occupations are included in the purview of the newly established agency 'Health Workforce Australia'. As broad a remit for the new agency as possible will be important for coordination and continuity of care — so as to avoid the problems associated with fragmented funding and delivery systems discussed above.

Health Workforce Australia will be establishing a National Health Workforce Statistical Resource (based on data from the national registration and accreditation scheme)[15] to assist with longer term planning initiatives and to provide advice regarding workforce directions. Eye care professionals and allied workers need to be included on this Resource.

In addition, eye care professionals and allied workers need to be included in the workforce audit to be undertaken as part of the COAG *National Partnership Agreement on Preventive Health*.

As consumer expectations and demands change over time with education and awareness of health services that are available, there are ramifications for the workforce. For instance, the development of further specialisation means that a greater level of granularity is required in the statistics available to promote an understanding of the emerging specialties (for example, ophthalmologists specialising on corneal disease only cannot be counted in the number of surgeons providing generalist services such as cataract surgery). Quantitative as well as qualitative modelling and locational mapping of the dimensions of the workforce involved in eye care is important. Quantitative projections of the extent and nature of gaps over time between the need for eye care services and the supply of these services is as important as qualitative analysis, providing useful inputs to plans for training and other aspects of workforce policy.

Eye health workforce planning and delivery is an enormous issue, not least in terms of access for those in rural and remote and Aboriginal and Torres Strait islander communities. To date, the Government has focussed on workforce assistance for general practitioners given the urgency of the need for more doctors in rural and regional Australia. A package of innovative approaches is likely to be required for the eye heath workforce in addressing distribution issues similar to those adopted for general practice, including incentive arrangements, outreach services, and upskilling general practitioners or other primary health providers to undertake basic ophthalmic examinations and procedures, and upskilling nurses and Aboriginal health workers in some areas of preventive and primary eye care — particularly in rural and remote areas. An expansion of telemedicine should also be explored.

Lastly, ophthalmologists do not appear to be well represented in the 'Medicine in Australia: Balancing Employment and Life' (MABEL) longitudinal survey. Encouragement to

[15] The National Partnership Agreement on Hospital and Health Workforce Reform — description of workforce enablers in Schedule B

ophthalmologists to participate, and encouragement to those responsible for MABEL to promote the survey among ophthalmologists would be beneficial.

9.2.8 Education and Employment

Like the rest of the population, higher rates of education among those with vision loss are associated with a greater likelihood of employment (Vision Australia 2007). Education of people who are blind or partially sighted is at least as important as for other Australians in ensuring stability of income and participation in employment.

In addition, the ability of those with vision loss to access information generally via Braille, electronic information formats, large print (with or without technology) is linked to their likelihood of employment (Vision Australia 2007).

The main barriers to employment faced by people with vision loss include:

- difficulties completing paper forms;
- problems accessing online applications though specialist technology;
- difficulties reading print material provided at interviews or in assessment centres;
- the requirement for a drivers licence to comply with selection criteria; and
- encountering employers who had preconceived ideas about the capabilities (or disabilities) of the applicant (Vision Australia 2007).

Access to appropriate Employment Services is important in overcoming some of these barriers and ensuring people with vision loss are able to access information about the job market. The Vision Australia (2007) employment survey found that the more formats of material people can access, the higher their employment opportunities. Moreover, job seekers who are blind or have low vision are more likely to be employed if they have used low vision employment services, or services of the Disability Employment Network (DEN), compared to those who do not use these services (Vision Australia 2007).

Vision Australia (2007) recommended that

- Discretionary items (such as drivers' licences) should not be used in recruitment policies.
- Job application processes requiring electronic registration should not exclude those using adaptive technologies or place additional barriers to job seekers who are blind or have low vision.
- Information about job opportunities should be available to people who are blind or have low vision (including those using adaptive technologies).

9.2.9 The need for government vision health directorates

Nearly 6% of Australians aged 40 or over experienced vision loss in 2009. Without changes in policies and available treatments, the prevalence of vision loss in that age group will rise to around 7% in 2020 due to demographic ageing.

Vision 2020 Australia has recommended a new 10 year Eye Health and Vision Care Strategy for Australia, modelled on the attainment of the World Health Assembly Action Plan objectives, be developed in consultation with Vision 2020 Australia members and endorsed by the Council of

Australian Governments (COAG). Vision 2020 Australia has further recommended that a vision health directorate be established within the Commonwealth Government to oversee the new Strategy.

The move to greater centralisation of funding for hospitals, primary care and aged care within the Commonwealth purview means it is important that a vision health directorate be established with the Commonwealth Government whether or not there is a new Strategy.

The current reforms also allocate responsibility for care of young people with a disability with State and Territory governments — so vision health directorates are needed within State and Territory Governments as well.

The substantial risk of silos preventing people who are disabled by vision loss accessing appropriate, cost effective services across the spectrum (health, disability, ageing, transport, education and employment) adds to the case for vision health directorates, and their careful placement within government — for example — in a central agency. The directorates would also be well placed to track the impact of reforms on those with vision loss. Health system reform will occur over a period of time during which there will be potential for confusion about the allocation of responsibilities. People with a disability such as vision loss are at especial risk.

- The pace of reform to disability services is slower than that in health and unforeseen service gaps may emerge between disability and health services while reforms are in progress.
- People with vision loss who have difficulty accessing information may experience difficulty accessing services that are affected by reform.

9.3 Summary and conclusion

Vision loss affected more than half a million Australians aged 40 or over in 2009. Demographic projections suggest that around 800,000 Australians will have vision loss by 2020. Vision loss comes with a substantial cost to quality of life and the financial cost of vision loss was estimated to be $7.2 billion in 2009.

Many cases of vision loss are avoidable, and thus the costs are unnecessary. Improving awareness about how to avoid vision loss, and ensuring access to eye care services, including prevention, treatment and rehabilitation services, are important.

Australian has joined with other countries in the drive to eliminate avoidable blindness by 2020. *VISION 2020: The Right to Sight* is a collaborative effort between WHO and a number of partners. However, in the current reform environment, this goal is in danger of being lost.

An analysis of the foreshadowed health reforms was conducted with a view to investigating the implications for Australians' eye health. The findings are summarised as follows.

System structure

While funding for hospitals, primary care and aged care will be centralised within the Commonwealth purview, responsibility for care of young people with a disability will remain with State and Territory governments. New agencies and organisations are being established

— for example, Medicare Locals, GP Super Clinics, local hospital networks, the National Preventive Health Agency, and Health Workforce Australia.

- Fragmentation will remain a key issue for the health system, as well as for government agencies more broadly.
- Fragmented funding and service delivery is a considerable challenge for people with vision loss or who have low vision or blindness. They need a range of health, disability, aged care, education, housing, employment and transport services. Lack of coordination and cooperation can have adverse outcomes for people with vision loss.

The need for evidence, evaluation and data

Ongoing high quality epidemiological, clinical, economic, health services and evaluation research is required to underpin eye health policy and practice. The recommendations for improving the evidence base endorsed by the Australian Health Ministers' Conference (2005) remain relevant.

Eye health needs to be incorporated into the preventive health research agenda as well as other longstanding research agendas.

It is not possible with current data sets available to gauge Australia's success in reducing avoidable blindness. This needs to be rectified. The heightened emphasis on transparency and reporting of outputs and outcomes as part of the health reform initiatives is welcomed. This should also be matched in the disability services sector. Increased efforts to coordinate data sets and continue expanding linkages across administrative data sets are to be applauded.

Vision as a public health issue

Vision health needs to be elevated as a public health issue (to the same level as smoking cessation or obesity). Eye health messages need to be included in all prevention campaigns, with messages targeted at 'at risk' populations.

- Promotion and prevention strategies need to be integrated and education of GPs, nurses and allied care professionals is an important complement to social marketing campaigns aimed at educating consumers. The primary health care workforce needs to be able to identify vision loss, detect eye disease and refer appropriately
- Regular eye health tests should be promoted. Regular eye examinations are required for early detection of eye disease and will reduce vision loss from AMD, diabetes and glaucoma. These tests are subsidised by Medicare.

Chronic disease

- Care of eye health needs to be integrated into primary health care chronic disease management programs. The initial focus on diabetes is welcomed, particularly as ophthalmic complications of diabetes have the highest hospitalisations of all diabetes complications.
- Current data suggest few people with diabetes receive regular eye exams consistent with the NHMRC guidelines (2008). Retinal photography needs to be encouraged. Use of retinal photography means it is easier to educate to achieve more effective diagnosis and it is very cost effective, saving $33.24 in the cost of each screen relative to more traditional diagnostic methods (Access Economics 2005a).

Acute care

- Public hospital elective surgery waiting times for ophthalmology procedures remain worse than average. Ophthalmology waiting times are not reported by urgency category, so it is not possible to judge whether patients wait longer than is recommended for ophthalmology care. Waiting list management and monitoring are still required to ensure patients do not wait unnecessarily long for cataract surgery. In addition, ophthalmology and procedural waiting lists need to be publicly reported by urgency category.

The workforce

- Addressing constraints on training, including in both the public and the private sector, is very important. In particular, to sustain the ophthalmologist workforce, there is a need for trainers who provide training services in private practices.
- There are similar constraints on the clinical training of optometrists; in respect of optometrists updating their abilities to use and prescribe scheduled medicines.
- The eye health workforce is not restricted to ophthalmologists and optometrists but includes GPs, ophthalmic nurses, orthoptists, optical dispensers and optical technicians. Rehabilitation workers, occupational therapists, orientation and mobility specialists, and employment consultants are also important in assisting people with vision loss to achieve independence and quality of life. The newly established agency 'Health Workforce Australia' needs to have as broad a remit as possible to ensure coordination and continuity of care — and to avoid the problems associated with fragmented funding and delivery systems.
- Eye care professionals and allied workers need to be included in the National Health Workforce Statistical Resource. In addition, eye care professionals and allied workers need to be included in the preventive health workforce audit and strategy.

Education and employment

- Education of people who are blind or partially sighted is at least as important as for other Australians in ensuring stability of income and participation in employment.
- In addition, the ability of those with vision loss to access information generally via Braille, electronic information formats, large print (with or without technology) is linked to their likelihood of employment.
- People with low vision or who are blind need access to appropriate employment services to expand their employment opportunities. In addition, Vision Australia (2007) recommendations to reduce barriers to employment need to be implemented.

Reform to the health system will take several years. However, the goal of eliminating avoidable vision loss can still be achieved while reform is underway. Regular eye tests for early detection of eye conditions are available and affordable and can ultimately reduce vision loss from cataract, refractive error, AMD, diabetes and glaucoma — the most common causes of vision loss in Australia.

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