Eye Research Australia

Clear Insight

The Economic Impact and Cost of Vision Loss in Australia

A Report prepared by **Access Economics Pty Limited**

ACCESS ECONOMICS

Acknowledgements and Disclaimer

This Report was prepared by Access Economics Pty Limited for the Centre for Eye Research Australia and the Eye Research Australia Foundation. It was funded by an unrestricted grant from Alcon Laboratories (Australia) Pty Ltd who had no part in the direction or findings contained in this Report.

Access Economics Pty Limited would like to acknowledge with appreciation the comments, prior research and expert input from:

Professor Hugh R Taylor, AC
Centre for Eye Research Australia

Associate Professor Jill Keeffe
Centre for Eye Research Australia

Professor Paul Mitchell
Centre for Vision Research at the University of Sydney

Additional assistance was provided by: Associate Professors Tien Wong and Robyn Guymer and Drs Alex Harper and Julian Rait, all from the Centre for Eye Research Australia, University of Melbourne.

Eye Research Australia acknowledges the support of Access Economics Pty Limited in particular that of **Lynne Pezzullo**.

The financial support of Alcon Laboratories (Australia) Pty Ltd is gratefully acknowledged.

The Centre for Eye Research Australia is a core partner of the Vision CRC, and is proud to be a partner of Vision 2020. Support from these organisations and the RANZCO Eye Foundation is much appreciated.

August 2004

Contents

Figures

Tables

Executive summary

Visual impairment is a huge and vastly under-treated problem in Australia.

- Over 480,000 Australians are visually impaired in both eyes (visual acuity <6/12) and over 50,000 of these people are blind (visual acuity <6/60 or visual field <10º diameter).
- Nearly 300,000 Australians have visual impairment because of under-corrected refractive error. However,180,000 Australians have visual impairment due to other causes that cannot be corrected by spectacles.
    - Because these conditions are highly age-correlated, visual impairment is projected to increase from 5.4% of the over-40 population today to 6.5% - nearly 800,000 people - by 2024. Blindness is set to increase by 73% over the next two decades to more than 87,000 people over 40.

Most visual impairment and blindness is caused by conditions that are preventable or treatable.

- There are five main eye conditions, which together account for around three quarters of vision loss.
    - For visual impairment they are cataract (14%), macular degeneration (10%), glaucoma (3%), diabetic eye disease (2%) and refractive error (62%).
    - For blindness they are cataract (12%), macular degeneration (48%), glaucoma (14%), diabetic and other retinal disease (11%) and refractive error (4%).

The health costs of treating eye disease are extremely large - $1.8 billion in 2004. This is more than the cost of coronary heart disease, stroke, arthritis or depression. It represents more than health spending on two National Health Priority areas - diabetes and asthma - combined.

- Hospital costs represent $692million, and out-of-hospital medical costs are $406 million.
- Cataract is the largest single cost item - $327 million or 18% of the total.
    - This is similar to eye care spending on the largest age-gender group - women aged over 75, who currently receive $319m or around $1 of every $5.70 spent on eye care.
- Optometry services cost $187 million (10% of total spending) - wholly for refractive error.
- Average health spending on eye care for people over 40 with visual impairment is $2,762 per annum, compared to $1,847 in 1993-94.
- Total spending on eye care is up from $839 million in 1993-94, although comparisons between the periods are very limited by data composition issues.

By 2020, health costs are conservatively projected to more than double again to to $3.7 billion, primarily due to demographic ageing.

- By the end of next decade, hospital costs for eye care will reach $1.45 billion, cataract will cost $668 million per annum, and more than $1 in every $2 will be spent on Australians aged 65 and over.
- International comparisons demonstrate similar trends in the US and UK.

Even more important are the indirect costs of visual impairment, which outweigh the health costs nearly 1.8:1. Indirect financial costs add another $3.2 billion to the annual bill for visual impairment.

- Lost earnings for visually impaired and blind people are estimated to cost the economy nearly $1.8 billion in 2004.
- The cost of carers, including their lost productivity (earnings), is estimated as $845 million.
- Aids, equipment, home modifications and other indirect costs are estimated as $371 million.
- Deadweight losses associated with transfer payments (taxation revenue foregone and welfare payments) are estimated as $208 million.
    - The transfers themselves sum to $850 million, but are not real economic costs, so are not included in totals.

Visual impairment and blindness impose substantial morbidity and premature mortality on the population.

- There are well-established correlations between visual impairment and higher risk of falls, hip fractures, motor vehicle accidents and depression - with risk of death elevated to 4.3% for those over 40 compared to 1.6% for the fully sighted.
- Of the 70,668 visually impaired Australians who die in 2004, we estimate 584 deaths can be said to result from the visual impairment (an 'attributable fraction' for mortality of 0.83%).
- Socio-economic impacts include lower employment rates, higher use of services, social isolation, emotional distress and may lead to an earlier need for nursing home care.

Executive summary

The suffering and premature death associated with visual impairment is estimated to impose a further massive $4.8 billion - the value of the loss of healthy life, after netting out other costs borne by the visually impaired.

- These calculations are based on attributing the value of a statistical life as $3.7 million, implying a discounted (at 3.3%) life year valued at just over $160,000 - based on the international literature and methodology.
  - Sensitivity analysis to these assumptions puts the range from $3.2 billion to $9.9 billion.
- The inclusion of a value for suffering increases the real annual eye care bill to $9.8 billion in 2004.
- In terms of disability adjusted life years, the burden of disease for visual disorders is over 40,000 DALYs in 2004, including an estimate for diabetic retinopathy.
- The years of life lost due to disability (YLD) from visual disorders is 2.7% of the national total, similar to that of diabetes and coronary heart disease and significantly greater than the disability burden for breast cancer, prostate cancer, melanoma or HIV/AIDS.

Excluding suffering, direct and indirect costs are $5.0 billion in 2004.

- This represents 0.6% of GDP or $252 for every Australian man, woman and child, every year.

Eye care has a range of proven, low risk, high success and cost-effective interventions - which are considered cost-effective by the World Bank in Australia if they are under $A112,000 per QALY (quality adjusted life year).

- Cataract surgery for the first eye at US$2,020/QALY or the second eye at US$2,727 is also highly cost-effective.
- Regular retinal photographic screening for diabetic retinopathy costs only US$15,000/QALY even in rural and remote areas.
- US cost effectiveness analysis shows that laser therapies generally cost under US$20,000 per QALY and most forms are well under US$10,000.
- Vitrectomy is extremely cost-effective at only US$2,000/QALY.

Blindness and cancer are the two most feared health conditions that people want to prevent.

- Australia has good tertiary and secondary eye care services. We also have some of the best data in the world from the Melbourne Visual Impairment Project (VIP) and the Blue Mountains Eye Study (BMES) on the distribution and impact of visual impairment, which reveal looming issues of demographic ageing.
- Projected prevalence, cost and burden of disease figures presented in this report confirm the need to develop and utilise cost-effective interventions to improve the eyesight of the increasing number of people who would otherwise lose vision.
- Australia needs to take vision loss seriously. Blindness and vision loss have huge and broad-ranging impacts on our society. Much blindness and vision loss can be prevented or treated with cost-effective interventions.

Half of visual impairment is correctable and one quarter is preventable.

- Prevention is often more cost-effective than treatment, so there is a need to promote education and awareness raising public health actions.
- Research is necessary, with potentially exceptional returns, to address the questions of blindness and vision loss that currently are unable to be prevented or comprehensively treated, for example macular degeneration and glaucoma.
- There is a need for rehabilitation services for most people with vision loss, however less than a quarter of people with vision loss access these services.
- The distribution of eye care services needs to be improved, especially the delivery of models available in rural and remote Australia.

Executive summary

Well-constructed strategies, such as those of the global coalition Vision 2020, are available that can be implemented without delay.

- Vision 2020 Australia is a collaborative initiative of local eye health, research and service organisations cooperating to eliminate avoidable blindness and vision loss by the year 2020.
- This report endorses their recommendation that the Commonwealth Government and Vision 2020 Australia form a Working Group to implement the following agenda aimed towards achieving the "Right to Sight" by the year 2020.
  - That Commonwealth, State and Territory Governments commit to work together with Vision 2020 Australia to eradicate preventable blindness and its impact through appropriate funding, early detection, prevention, rehabilitation, education and research.
  - That the Commonwealth Government include the issue of eye health and vision care on the national health agenda.
  - That Governments in conjunction with Vision 2020 Australia and its partners develop strategies along the lines of the Vision Initiative in Victoria to ensure that every Australian has equitable access to eye health and rehabilitation services and develop general awareness strategies on:
    - the need for regular eye examinations;
    - the need for sunglasses and protective eye wear;
    - the strong linkage between smoking and eye disease; and
    - that vision loss is not a necessary consequence of ageing.

1. Prevalence and risk factors

Over 9.7 million Australians report diseases of the eye and adnexa (ABS, 2002a). Many thousands of Australians are needlessly blind or vision impaired. Almost 50% of blindness and 70% of visual impairment in Australia is caused by conditions that are preventable or treatable (Taylor, 2003). In the past, only the tip of this iceberg has been identified and addressed, yet there are a series of specific and quite simple interventions that can significantly reduce its impact.

Visual impairment can be broadly defined as a limitation in one or more functions of the eye or visual system, most commonly impairment of visual acuity (sharpness or clarity of vision), visual fields (the ability to detect objects to either side, or above or below the direction in which they are looking) and colour vision.

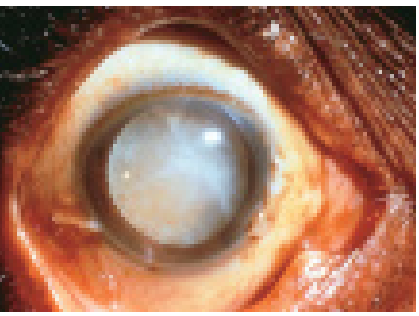
Normal vision is recorded as 6/6, (20/20 in Imperial measures), which means that a person can see at 6 metres what a person with normal vision can see at 6 metres. Degrees of visual impairment are measured similarly, where the first number is the furthermost distance at which the person can clearly see an object, and the second number is the distance at which a person with normal vision could see the same object. For example, 6/12 vision means that the person can clearly see at 6 metres (but not more), an object that a person with unimpaired vision could see at 12 metres (but not more).

Legal blindness in Australia is defined as distance vision acuity of <6/60 in the better eye with correction (ie, with the use of glasses or contact lenses) or a visual field of less than 10°, 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. Visual field is measured in terms of degrees from the point of fixation. For example, <10° field means that the person can only see in a visual field of less than 10 degrees radius from the point of fixation. Colour blindness - a genetic inability or, more commonly, reduced ability to distinguish differences in hue - is not a subject of this report.

Visual impairment is defined in this report as less than driving vision, <6/12. Legal blindness is defined as <6/60, or a visual field of less than 10°, or both.

This chapter summarises the five main causes of visual impairment, which together account for around three quarters of vision loss - refractive error, macular degeneration, cataract, glaucoma and diabetic eye disease. Morbidity, mortality, demographic prevalence and socio-economic impacts are addressed, as well as risk factors and preventive, management and treatment options. Risk factors for visual impairment include age, family history of eye conditions, diabetes, smoking, exposure to sunlight and being indigenous.

1.1 Cataract



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. This is a cataract. 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 causes of cataract:

- **Age-related cataract:** Most cataracts are related to aging.
- **Congenital cataract:** Some babies are born with cataracts or develop them in childhood, often in both eyes. If they affect vision, they may need to be removed.
- **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.

Causes of cataract are still uncertain. Age, smoking, diabetes and ultraviolet (UV) exposure increase 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 (eg, interfering with daily activities), surgery may be needed to improve vision. The surgeon removes the cloudy lens and replaces it with a substitute lens. Cataracts in both eyes need to be removed separately. Cataracts should also be removed if they prevent examination or treatment of another eye problem such as AMD or diabetic retinopathy.

Today, cataract surgery is safe and very effective, with almost all people having better vision and improved quality of life afterward, and only 1-2% experiencing complications such as infection, bleeding or inflammation (National Eye Institute, 1998a1). Cataract surgery is generally performed as day surgery without general anaesthetic, with a 6-week total recovery period.

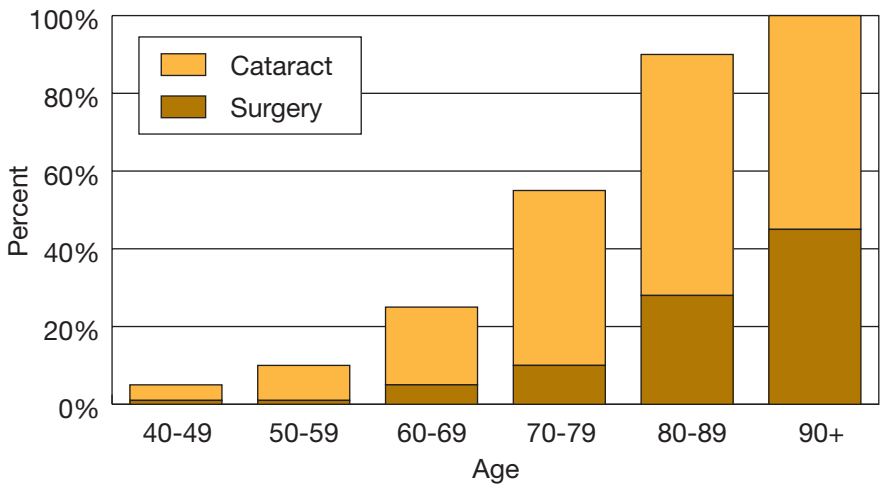
The average Federal cost of cataract surgery, calculated from HIC data, is $3,150, noting that some private health insurance (PHI) case payment arrangements may be as low as $1600.

Cataract

Prevalence of cataract in Australia

Cataract is a large and growing issue in Australia. Ten-year prevalence of cataract increases from just under 5% in the 40-49 year age group to 100% in the 90+ age-group (Taylor 2001), with surgery required in up to half of these cases (see Figure 1-1). In all there are around 1.4m Australians (17.2% of the population over 40) affected by significant cataract, with cohort prevalence rates not differing significantly compared to the US and Europe (Congdon et al, 2004).

Figure 1-1: Demographic distribution of cataract, Australians over 40



Source: Taylor (2001)

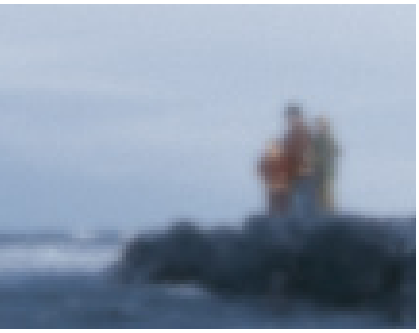
Taylor (2003) forecasts that the need for cataract surgery will double in 20 years - with already around 160,000 cataract operations performed per year. This gives a cataract surgery rate of 8,000 per million per year. Everyone will develop cataract if they live long enough and half will have cataract surgery. Because the rate of cataract surgery doubles with each decade of life, a delay of onset of cataract by just ten years would reduce the need for surgery by half.

Addressing smoking and high UV exposure risk factors would halve the need for cataract surgery.

Everyone will develop cataract and half will have cataract surgery if they live long enough.

[1] Based on the work of Earl P Steinberg from the US PORT patient outcomes studies.

Normal vision



The same scene as it might be viewed by a person with cataracts

Prevalence of visual impairment from cataract.

Combined data from the Melbourne Visual Impairment Project (VIP) and Blue Mountains Eye Study (BMES) show that 68,657 Australians are visually impaired from cataract of whom 9% or 6,111 people are blind (see Table 1-1). Prior to age 50, cataract is a relatively rare cause of visual impairment. After that, prevalence increases from 0.1% in the 60-69 year age group to 15.2% in the population over 90. Demographic ageing over the coming decades will result in those blind from cataract increasing by 75% to 10,707 by 2024, and those with visual impairment increasing by 73% to 118,750 people, unless there is increased prevention activity.

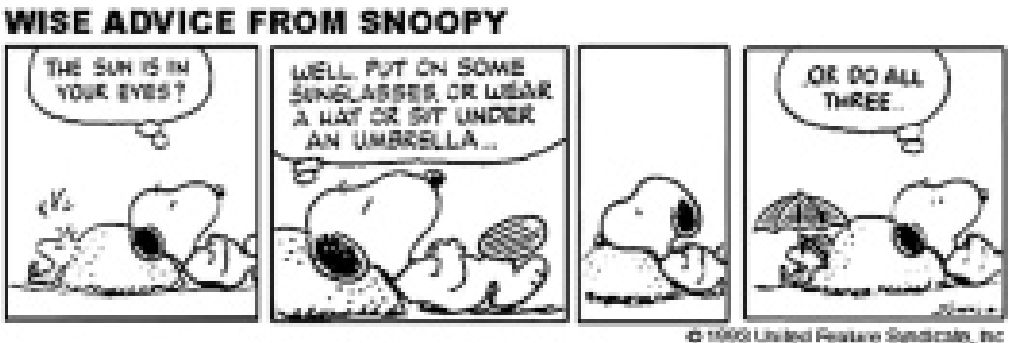
Table 1-1: Visual impairment from cataract by age, Australia, 2004-24

	% pop'n	Prevalence (estimated numbers)				
	1996	2004	2010	2014	2020	2024
40-49	-	-	-	-	-	-
50-59	0.0	1,006	1,124	1,197	1,286	1,250
60-69	0.1	1,270	1,596	1,965	2,206	2,355
70-79	1.4	17,194	18,027	20,022	26,005	31,202
80-89	6.6	39,900	48,501	52,425	59,091	66,929
90+	15.2	9,285	12,350	14,038	15,530	17,014
Total VI		**68,657**	**81,599**	**89,647**	**104,118**	**118,750**
VI (% of >40s)		**0.77%**	**0.82%**	**0.84%**	**0.89%**	**0.97%**
Total blind		**6,111**	**7,596**	**8,409**	**9,536**	**10,707**
Blind (% of >40s)		**0.068%**	**0.076%**	**0.078%**	**0.082%**	**0.087%**

Source: Access Economics Pty Limited from VIP, BMES and ABS population data.

Strategic interventions to reduce visual impairment from cataract include:

- promote protective behaviour: stop smoking and reduce ocular UV exposure;
- detect those with unoperated cataract with simple aged-care vision tests;
- improve efficiency and capacity of cataract surgery services; and
- have all Australians test their vision on a regular basis (every 4 to 5 years).



Source: www.mdsupport.org/library/md_description.html

1.2 Diabetic Retinopathy

All people with diabetes mellitus (DM) - both type 1 and type 2 - are at risk of developing diabetic retinopathy (DR) and should have a comprehensive dilated eye exam at least once every two years. 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.

Lack of awareness is a major impediment to regular screening.

DR is an important cause of visual impairment. 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.

People with diabetes have 25 times the risk of vision loss.

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.

Macular oedema and DR are detected during an eye exam that includes a visual acuity test (eye chart test), examination of the back of the eye (retina) with an ophthalmoscope after dilating the pupil with drops, or with a retinal photograph. Checks are made for leaking or changed blood vessels, fatty deposits on the retina (signs of leaking blood vessels), retinal swelling and pale, damaged nerve tissue. If these are detected there may also be a need for a fluorescein angiogram.

Treatment of macular oedema is with focal laser surgery, placing small laser burns in the areas of retinal leakage surrounding the macula, which slows the leakage of fluid and reduces the amount of fluid in the retina. A person may need focal laser surgery more than once. Focal laser treatment stabilises vision and reduces the risk of vision loss by 50%. In a small number of cases, if vision is lost, it can be improved. Treatment of early stages of DR is not needed, unless there is also macular oedema. To prevent onset and progression of DR (and the need for surgery), people with diabetes should control their levels of blood sugar, blood pressure, and blood cholesterol.

Normal vision

The same scene as it might be viewed by a person with diabetic retinopathy

Proliferative retinopathy is treated with scatter laser surgery, where up to a couple of thousand laser burns are made in the retina away from the macula, causing the abnormal blood vessels to shrink. Although scatter laser treatment can worsen peripheral, colour and/or night vision, it can save the rest of a person's sight. Scatter laser treatment works better before the fragile, new blood vessels have started to bleed.

If the bleeding is severe and persistent, a *vitrectomy* may be necessary, where blood and gel are removed from the centre of the eye and replaced with a salt solution. While laser surgery can usually be performed as an outpatient with numbing eye-drops, a vitrectomy must be performed under either local or general anaesthesia. Day surgery is normal although sometimes an overnight hospital stay is required. Eye patches and eye-drops are used post-operatively.

Laser treatment and vitrectomy are both very effective in reducing vision loss, reducing the risk of blindness by 98% (see Section 4.2). Although both treatments have high success rates, they do not cure DR and there is always the risk of new bleeding. Multiple treatments may be necessary to protect sight.

There are many low vision services (eg, rehabilitation, counselling and information) and special devices that can help people make the most of their remaining vision. Research is seeking better ways to detect, treat, and prevent vision loss; for example, in people with diabetes researchers are studying drugs that may stop the retina from sending signals to the body to grow new blood vessels, with a view to reducing the need for laser surgery.

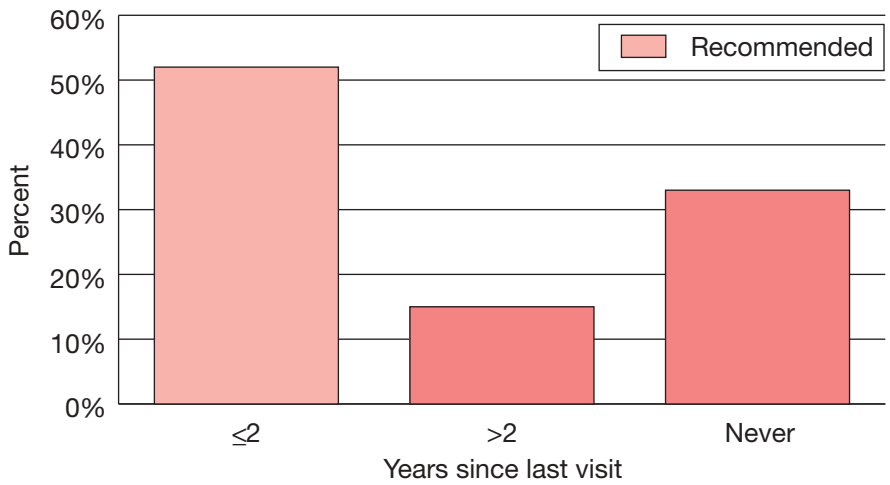
Prevalence of DR

The prevalence of DR is of course highly dependent on the prevalence of diabetes mellitus (DM). There are around half a million Australians over 40 confirmed with DM (ABS, 2002a and AusDiab, 2001), projected to increase to over 700,000 by 2020. An additional 400,000 with diabetes are undiagnosed (AIHW, 2002). Tapp et al (2003) from the AusDiab Study Group conclude that 15.3% of those with DM have DR, although other population-based and clinic-based studies have suggested up to one third over 40 with diagnosed DM will have DR (reviewed by NHMRC, 1997).

Taylor (2001) estimates that only half the Australians with diabetes have a regular eye exam and one third have never been checked (Figure 1-2).

Diabetic Retinopathy

Figure 1-2: Diabetic retinopathy eye examination



Source: Taylor (2001).

Estimates are that only half the Australians with diabetes have a regular eye exam and one third have never been checked.

Prevalence of visual impairment from DR

Australian data from the VIP and BMES show a very small proportion - only 0.1% of the population over 40 - 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 the 4.1m Americans with DR or 900,000 people) have vision-threatening DR. The sample data were also inadequate to determine the proportion of those with vision-impairing DR who are blind.

98% of severe vision loss from diabetes can be prevented with appropriate treatment.

The low Australian results may very well be a result of small sample size in the source studies and high standard errors. In the VIP, the number of people with diabetes was only 233, so the estimates in Table 1-2 above should be treated with caution. A minimum estimate of the number of Australians with vision-impairing DR is 7,758, rising to over 12,480 by 2024. This represents around 1.6% of Australians who have DM in 2004.

Table 1-2: Visual impairment from diabetic retinopathy by age, Australia, 2004-24

	% pop'n	Prevalence (estimated numbers)				
	1996	2004	2010	2014	2020	2024
40-49	-	-	-	-	-	-
50-59	0.04%	1,155	1,269	1,341	1,309	1,398
60-69	0.16%	2,588	3,373	3,862	4,298	4,569
70-79	0.06%	638	713	827	1,126	1,208
80-89	0.51%	2,990	3,325	3,394	3,911	4,597
90+	0.58%	386	514	584	646	708
Total VI		**7,758**	**9,195**	**10,008**	**11,291**	**12,480**
VI (% of >40s)		**0.087%**	**0.092%**	**0.093%**	**0.097%**	**0.102%**
Total blind	**na**	**na**	**na**	**na**	**na**	**na**
Blind (% of >40s)	**na**	**na**	**na**	**na**	**na**	**na**

Source: Access Economics Pty Limited from VIP, BMES and ABS population data.
Note: The data in this table have high standard errors and should be used with caution.

Over 2,500 of those with vision-impairing DR are of working age. Kempen et al (2004) observes that:

> *"Diabetic retinopathy often causes blindness during the working age years, resulting in a larger number of person-years of vision lost per case, more disability during the working years per case, and correspondingly large economic costs. In addition, most vision loss due to DR is avoidable, through primary... and secondary prevention."*

Suggested strategic interventions to improve vision caused by DR include:

- promote awareness amongst those with diabetes of the need for regular eye examinations;
- involve all members of the diabetes management team in promoting eye examinations every two years;
- update training for eye care professionals so that patient management follows clinical practice guidelines; and
- develop, evaluate and report sustainable local and regional models of screening.

1.3 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.

A family history of glaucoma increases risk of glaucoma at least four times.

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 age, family history and ethnicity. A family history of glaucoma increases risk of glaucoma at least four times and some glaucoma genes have been identified.

Glaucoma is detected through an eye examination including visual acuity, visual field, tonometry and optic nerve examination.

If glaucoma is detected early and treated effectively, loss of vision can be prevented or delayed.

Although there is no cure for glaucoma, early diagnosis and treatment are important to control it and thus protect sight. Treatments include:

- **Medicine** (very common) - eyedrops and/or pills taken several times a day can lower pressure by helping fluid drain from the eye or causing the eye to make less fluid. Rare side effects include headaches, eye irritation (stinging, burning, redness).
- **Laser surgery** ('laser trabeculoplasty') - helps fluid drain from the eye by burning about 50-100 enlarged holes in the meshwork with a high-energy light beam. The effects of laser surgery wear off so that, two years on, the pressure increases again in more than half of all patients. Repeating laser surgery is often not useful.
- **Conventional surgery** - can make a new opening for the fluid to leave the eye, often performed after medicine and laser surgery have failed to control pressure. Surgery is around 80-90% effective at lowering pressure. However, if the new drainage opening closes, a second operation may be needed. Conventional surgery works best in the absence of other previous eye surgery, such as a cataract operation.

Normal vision

The same scene as it might be viewed by a person with glaucoma

While glaucoma surgery may save remaining vision, it does not improve sight. In fact, vision may not be as good as it was before surgery. Possible side effects of glaucoma surgery include cataract, problems with the cornea, inflammation or infection inside the eye, and swelling of blood vessels behind the eye - all of which are treatable.

Apart from open-angle glaucoma, other types are as follows.

- **Closed-angle glaucoma** is where the fluid at the front of the eye cannot reach the angle because it gets blocked by part of the iris, resulting in a sudden increase in pressure. This accounts for less than 1% of glaucoma in Australia (Wensor et al, 1998). In acute cases of closed angle glaucoma, symptoms include severe pain, nausea, redness and blurred vision. This is a medical emergency, with immediate treatment required to improve the flow of fluid. Without treatment, the eye can become blind in as little as one or two days. Prompt laser surgery can usually clear the blockage and protect sight.

- **Congenital glaucoma** is where children are born with defects in the angle of the eye that slow the normal drainage of fluid, accounting for about 2% of glaucoma in Australia. There are obvious symptoms such as cloudy eyes, sensitivity to light, and excessive tearing. Surgery is the usual treatment and, if prompt, these children usually have an excellent chance of having good vision.

- **Secondary glaucomas**, about 3% of those in Australia, can develop as a complication of other medical conditions, such as surgery or advanced cataract, eye injuries, certain eye tumours, uveitis (eye inflammation), diabetes or the use of corticosteroid drugs. Treatment is again with medicines and laser or conventional surgery.

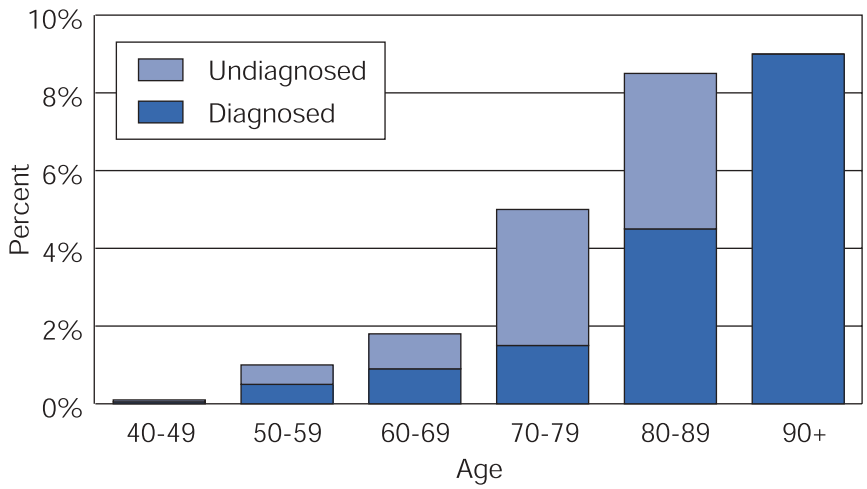
Research is important in understanding, preventing and treating glaucoma. Clinical studies are important in increasing knowledge about who is likely to get glaucoma, when to treat people with increased pressure, and which treatment to use first.

Prevalence of glaucoma in Australia

Half of those with glaucoma are undiagnosed.

Taylor (2001) estimates that one Australian in eleven will develop glaucoma, while 210,000 Australians already have it, but half of those have not been diagnosed (see Figure 1-3).

Figure 1-3: Demographic distribution of glaucoma, Australians over 40



Source: Taylor (2001)

Friedman et al (2004) found that the prevalence of open angle glaucoma in white people, based on meta-analysis of Australian, US and European data, increased from 0.4% in males aged 40-49 (0.8% for females the same age) to 5.6% for those in their nineties (6.9% for females). After controlling for age, there were no significant gender differences.

Prevalence of visual impairment from glaucoma

Australian VIP and BMES data show that glaucoma causing visual impairment is also age-related (Table 1-3). Over 13,700 Australians will have lost vision due to glaucoma in 2004, expected to rise to 23,507 by 2024. Over half of these Australians are blind, 6,901 people in 2004 rising to 12,595 over the next two decades.

Table 1-3: Visual impairment from glaucoma by age, Australia, 2004-24

	% pop'n	Prevalence (estimated numbers)				
	1996	2004	2010	2014	2020	2024
40-49	-	-	-	-	-	-
50-59	-	-	-	-	-	-
60-69	0.1%	1,191	1,487	1,853	2,083	2,225
70-79	0.3%	3,069	3,259	3,653	4,793	5,616
80-89	1.4%	8,669	10,268	10,924	12,387	14,176
90+	1.2%	813	1,081	1,229	1,359	1,489
Total VI		**13,741**	**16,096**	**17,658**	**20,623**	**23,507**
VI (% of >40s)	**0.15%**	**0.16%**	**0.16%**	**0.18%**	**0.19%**	
Total blind	**6,901**	**8,561**	**9,890**	**11,289**	**12,595**	
Blind (% of >40s)	**0.077%**	**0.086%**	**0.092%**	**0.097%**	**0.103%**	

Source: Access Economics Pty Limited from VIP, BMES and ABS population data.

Suggested strategic interventions to improve vision include:

- Promote community awareness about the family links for glaucoma;
- Have regular eye examinations for those with a family history of glaucoma and those over the age of 50; and
- Research to develop better ways of treating glaucoma and promoting clinical practice guidelines.

1.4 Age-related macular degeneration

AMD is an incurable eye disease and the leading cause of blindness in elderly people. The 'macula' is the part of the retina that enables central vision and seeing fine detail. Damage to the macula is characterised by a 'black spot' - losing the centre of the picture (see diagram).

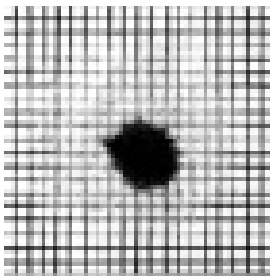
In "early AMD", small yellow deposits called *drusen* form under the macula. Vision is usually lost with more advanced stages of AMD. There are two types of "late AMD".

- **Dry (geographic/atrophic):** In one third of cases of late AMD, the macula thins. Vision loss is directly related to the location and amount of retinal thinning but the progress of dry AMD is slower than the "wet" type. There is no known treatment or cure for the "dry" type.

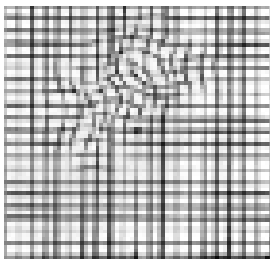
- **Wet (exudative/neovascular):** Two thirds of those with late AMD have this type, it accounts for 90% of all blindness from AMD (National Eye Institute, 2000b). Abnormal blood vessels grow under the retina and macula (*subretinal neovascularisation*), which bleed and leak fluid, causing the macula to bulge or lift up, distorting or destroying central vision. Vision loss may be rapid and severe. Thermal laser surgery may be indicated in the early stages of "wet" AMD. However, if the wet form of AMD is discovered early enough, laser treatment may prevent severe eye damage for some patients. A new treatment, *photodynamic laser therapy*, uses a light-activated drug called Visudyne to seal off leaking vessels while leaving healthy ones intact, providing an improvement over previous laser treatments. Unfortunately, even in the most successful treatments, it does not preclude reoccurrence, so that at best it appears to slow the rate of vision loss and may assist in preserving some central vision.

Diagnosis and monitoring of AMD includes tests such as Amsler's Chart, a grid that enables early detection of changes in vision from baseline. The diagram at right (top) shows distortion with wavy lines instead of straight lines, and at right (bottom) the typical central vision loss that occurs late in the disease.

Fluorescein angiography is a simple outpatient procedure, where a coloured dye is injected into the person's arm and a special camera is used to take photographs of the retina while the dye passes through it. The photographs show any abnormal fluids in the patient's eye, as well as what changes have occurred in the retina and where, helping the doctor decide whether the person could benefit from laser treatment. If the wet form of AMD is discovered early enough, laser treatment may prevent severe eye damage for some patients.



Blurry Areas and Black Spots



Wavy or Crooked Lines

The prevalence of visual impairment from AMD will almost double in 20 years.

People who currently smoke develop macular degeneration 3 times as frequently and 10 years earlier than nonsmokers or those who have stopped.

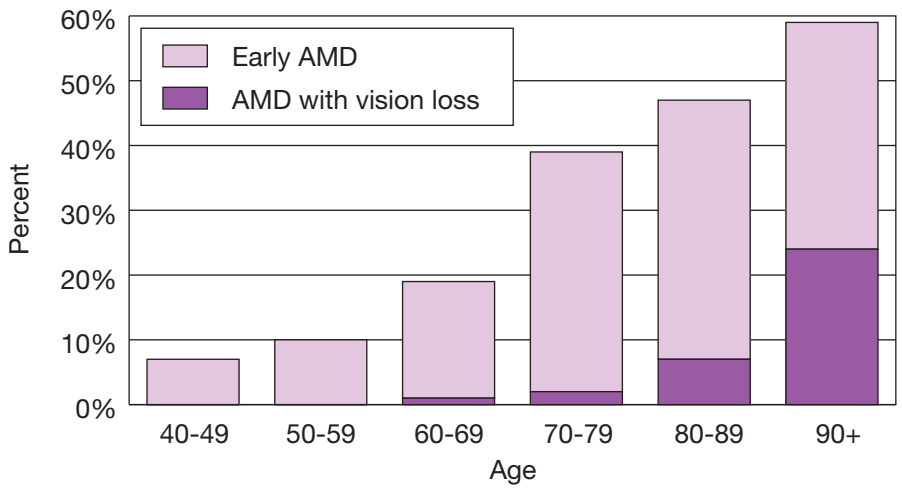
Causes of AMD are not well-understood, although there seems to be a strong genetic component. A family history of AMD increases the risk of AMD three to four times, but the genes for AMD have not yet been identified.[2] Smoking exacerbates risk, with about one quarter of Australian AMD potentially due to smoking (Smith et al, 1996, Taylor et al, 2000, Smith et al, 2001). Females may be more at risk, and people with elevated cholesterol levels (National Eye Institute, 2000b). Studies also suggest that progression may be slowed in a subset of high risk individuals by daily doses of antioxidants and zinc (AREDS, 2001). A diet rich in leafy green vegetables is often recommended, as is the avoidance of bright sunlight by wearing sunglasses and a wide-brimmed hat.

Prevalence of AMD in Australia

Nearly two out of three people will eventually develop AMD and one in four will lose vision.

There is a significant amount of early stage AMD in Australia, with ten-year prevalence rates as shown in Figure 1-4. Taylor (2001) estimates that nearly two out of three Australians who live into their nineties will develop macular degeneration and one in four will suffer a significant loss of vision from it.

Figure 1-4: Demographic distribution of AMD, Australians over 40



Source: Taylor (2001)

[2] New genetic research suggests that macular degeneration is a group of diseases that have one feature in common, a loss of central vision, which may affect people of any age. For example, juvenile macular degeneration, or Stargardt's Disease, is an inherited disease affecting one in 10,000 people, usually manifesting between the ages of 7 and 12. Presently there is no cure, nor any treatment proven to improve visual loss or retard such disease progression.

Age-related macular degeneration

Prevalence of visual impairment from AMD

The Melbourne VIP study provides data for AMD *resulting in visual impairment*, from which is derived a prevalence estimate for 2004 of 48,319 people. Around 33,700 of these people are likely to have neovascular AMD in at least one eye and nearly 27,350 to have geographic AMD in at least one eye, with a total of over 200,000 having large drusen in at least one eye, and around half of these having bilateral large drusen.[3]

Table 1-4: Visual impairment from AMD by age, Australia, 2004-24

	% pop'n	Prevalence (estimated numbers)				
	1996	2004	2010	2014	2020	2024
40-49	-	-	-	-	-	-
50-59	0.0%	1,316	1,447	1,529	1,493	1,594
60-69	0.0%	587	733	913	1,027	1,097
70-79	0.8%	10,469	10,846	11,946	15,363	18,852
80-89	4.6%	27,871	35,151	38,820	43,406	48,473
90+	13.0%	8,076	10,741	12,209	13,507	14,797
Total VI		**48,319**	**58,919**	**65,417**	**74,796**	**84,813**
VI (% of >40s)	**0.54%**	**0.59%**	**0.61%**	**0.64%**	**0.69%**	
Total blind	**24,204**	**29,694**	**32,746**	**37,443**	**42,167**	
Blind (% of >40s)	**0.27%**	**0.30%**	**0.31%**	**0.32%**	**0.34%**	

Source: Access Economics Pty Limited from VIP, BMES and ABS population data.

Table 1-4 shows age prevalence of AMD causing visual impairment, which increases from less than 0.1% in the 50-59 age group to 13.0% in those Australians aged over 90. Half of Australians who are visually impaired from AMD are, in fact, blind - over 24,000 people and increasing to over 42,000 by 2020 (0.7% of the population over 40).

Preventive strategies need to:

- encourage cessation of smoking;
- support access to optimal rehabilitation for all those with vision loss;
- research to confirm the genetic basis of AMD; and
- research to develop and evaluate new treatment strategies.

In most cases there is no effective prevention of or treatment for AMD. Because it is painless, usually progresses slowly and generally occurs in one eye first, it may be difficult to self-detect early.

[3] Estimates of the split are based on US data from Friedman et al (2004), noting that there would be 130,000 total AMD cases based on these data (all cases, not just those causing visual impairment).

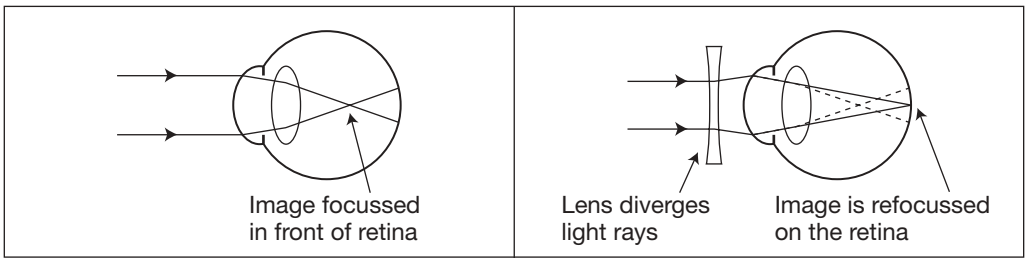
1.5 Refractive error

Refractive error can be corrected by glasses, contact lenses or refractive surgery.

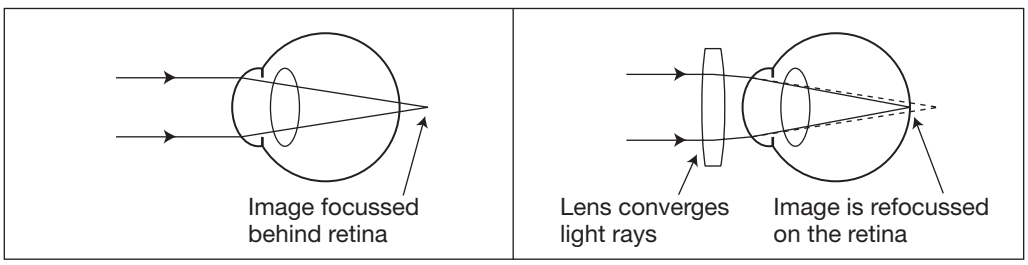
More than half of visual impairment is caused by refractive error, which means that the image of the object a person is looking at is not focussed properly onto the retina (the light-sensitive tissue in the back of the eye). Symptoms include blurred vision, eye strain, tiredness, reduced concentration and headaches, as the eyes try without success to correct the blur and because there is a tendency to screw up the eyes to try to see better, producing muscle discomfort in the eyelid and face.

There are three main types of refractive errors, which can affect people at any age, diagnosed through a simple vision test, and managed through wearing glasses or contact lenses (hard or soft). These three affect distance vision:

- **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, as per the diagram.

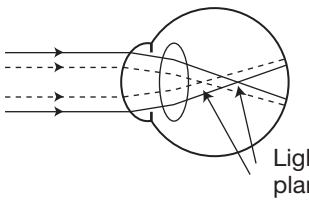


- **Hyperopia - long-sightedness**; the light focuses behind the retina so close images are blurred. The average person is a little hyperopic, however significant hyperopia cannot be accommodated and is thought to be genetic (the eyeball may be a little smaller than average). Retinoscopy and refraction tests are required for diagnosis, with correction through a convex lens, which converge the light rays, as per the diagram.



Refractive error

- **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 (see diagram below left). In the diagram (below right) some lines would appear clearer than others. 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 thus involve a compromise between optimal clarity and visual discomfort.



Light in different planes focussed at different points

There is also a fourth type of related eye focussing disorder which affects distant vision. It is related to age, and essentially affects everyone over the age of forty.

- **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 vision changes. Between the ages of 45 and 65, reading glasses may need to be changed every two to three years for optimal correction.

There are estimated to be nearly 300,000 Australians with undercorrected refractive error in 2004.

The cost of a pair of spectacle lenses can vary between $50 and $500 per pair, depending on lens design and material, coatings, tints and prescription. More complex lens designs tend to be more expensive, so progressive lenses cost more than bifocals, which cost more than single vision lenses. High refractive index materials are more expensive so, for a given prescription, thinner lenses cost more than thicker ones. Special features such as tints or anti-reflective coatings add to cost. Lenses to correct high or complex prescriptions have to be custom ground and so cost more. The cost of frames can vary from as little as $20 to thousands of dollars, with cost reflecting both quality and fashion.

A range of optometry and ophthalmology services are covered under Medicare, although gap payments for the latter are to be expected. Most States have spectacle subsidy schemes with restricted access based on lower income eligibility criteria. Spectacles (including prescription sunglasses) and contact lenses, and their repairs, are generally covered under private health insurance, usually with upper bounds (eg $160), annual caps (eg $320 per family), proof of prescription from a registered ophthalmologist or optometrist and observation of a waiting period (eg six months).

Prevalence of refractive error in Australia

Myopia has a strong genetic basis and is aggravated by near work.

Estimates from the VIP and BMES studies point to the prevalence of refractive error in Australia remaining fairly stable at just over 22% of the population over 40, although with an increase in absolute terms from 1.8 million people in 2000 to 2.5 million people in 2020 (Kempen et al, 2004). Hyperopia (measured as ≥3 diopters[4]) is estimated to increase from 471,000 to 721,000, and myopia (≤-1 diopter) is estimated to increase from 1.3 million people to 1.8 million, including an increase from 231,000 to 292,000 Australians with high myopia (≤-5 diopters). Australian prevalence is lower than in the US or Western Europe, where refractive error affects around one-third of people aged over 40, because of the older populations and higher prevalence rates there[5]. Both a genetic basis and near work are important in causing myopia. Table 1-5 summarises the results.

[4] A diopter is a measurement of the degree to which light converges or diverges, equal to the reciprocal of the focal length of a lens (in meters), e.g., a 2-diopter lens brings parallel rays of light to a focus at half a meter.

[5] Kempen et al (2004) utilise data from two studies in the United States (the Baltimore Maryland and Beaver Dam Wisconsin studies), one from Western Europe (the Rotterdam Netherlands study), and two from Australia (the Melbourne VIP and the Blue Mountains Eye Study).

Refractive error

Table 1-5: Prevalence of hyperopia and myopia, Australia and overseas

	2000		2020	
	% pop'n	M people	% pop'n	M people
United States				
Hyperopia ≥3diopters	9.9%	11.8	10.8%	16.6
Myopia ≥1diopter	25.4%	30.4	22.5%	34.7
of which ≥5diopters (high)	4.5%	5.3	4.0%	6.2
Total refractive error	35.3%	42.2	33.3%	51.3
Western Europe				
Hyperopia ≥3diopters	11.6%	21.6	12.8%	27.8
Myopia ≥1diopter	26.6%	49.6	26.5%	57.4
of which ≥5diopters (high)	4.6%	8.5	4.6%	10.0
Total refractive error	38.2%	71.2	39.3%	85.2
Australia				
Hyperopia ≥3diopters	5.8%	0.5	6.4%	0.7
Myopia ≥1diopter	16.4%	1.3	15.7%	1.8
of which ≥5diopters (high)	2.8%	0.2	2.6%	0.3
Total refractive error	22.2%	1.8	22.1%	2.5

Source: Access Economics Pty Limited based on Kempen et al (2004)

The Vision Cooperative Research Centre (CRC) aims to help correct and control myopia. The CRC, in which CERA is a core participant, was established in July 2003 through a Commonwealth CRC program grant for $32m over seven years, the highest CRC grant given.

Prevalence of visual impairment from refractive error

Table 1-6 shows the prevalence of visual impairment due to under-corrected refractive error by age. Under-corrected 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.

Table 1-6: Visual impairment from refractive error by age, Australia, 2004-24

	% pop'n	Prevalence (estimated numbers)				
	1996	2004	2010	2014	2020	2024
40-49	0.5%	14,980	15,001	15,595	15,402	15,437
50-59	1.8%	45,073	50,101	53,229	55,592	55,534
60-69	3.9%	61,479	79,029	93,005	103,862	110,588
70-79	7.8%	92,057	97,932	109,871	144,373	168,651
80-89	13.0%	77,957	92,761	98,969	112,105	128,058
90+	7.9%	5,196	6,910	7,855	8,690	9,520
Total VI		**296,742**	**341,735**	**378,523**	**440,024**	**487,788**
VI (% of >40s)		**3.3%**	**3.4%**	**3.5%**	**3.8%**	**4.0%**
Total blind		**1,882**	**2,252**	**2,348**	**2,667**	**3,014**
Blind (% of >40s)		**0.021%**	**0.023%**	**0.022%**	**0.023%**	**0.025%**

Source: Access Economics Pty Limited from VIP, BMES and ABS population data.

The table shows that there are estimated to be nearly 300,000 Australians with under-corrected refractive error in 2004 (3.3% of the population over 40), estimated to increase to nearly 488,000 (4.0%) by 2020. Prevalence increases with age from 0.5% in the 40-49 year age group to 13.0% among 80-89 year olds. Blindness from uncorrected refractive error increases from 1,882 people to 3,014 people.

To summarise, most visual impairment is due to refractive error and this is easily corrected:

- have all Australians test their vision on a regular basis;
- have all elderly Australians vision-tested as part of aged care assessments;
- establish appropriate referral pathways for those detected with poor vision
- improve access to subsidised spectacle programs;
- further research to understand the causes of myopia and the development of ways to prevent it; and
- research for better ways to correct or reverse myopia.

1.6 Summary of the impact of visual impairment

Visual impairment shortens life, increases the risk of other conditions, restricts social participation/independence across all domains of activity and impairs physical and mental health.

1.6.1 Prevalence

Prevalence of visual impairment is summarised in Table 1-7. In 2004 there are an estimated 480,000 Australians who are visually impaired, including over 50,000 (10.5%) who are blind (VA<6/60). Prevalence rates for visual impairment increase by age from 0.6% in the 40-49 age group to 40% for people aged over 90. Prevalence is projected to increase, due to demographic ageing and in a policy neutral environment, from 5.4% today to 6.5% - nearly 800,000 people - by 2024. Blindness is set to increase by 73% to 87,648 people in the over-40 group.

Table 1-7: Visual impairment from all sources, Australia, 2004-24

	% pop'n	Prevalence (estimated numbers)				
	1996	2004	2010	2014	2020	2024
40-49	0.6%	19,753	19,853	20,563	20,406	20,401
50-59	2.3%	57,496	63,808	67,740	70,113	70,669
60-69	4.7%	73,153	94,049	110,647	123,558	131,558
70-79	11.1%	132,201	140,177	156,911	205,652	241,676
80-89	28.7%	172,302	208,918	225,477	254,294	288,308
90+	40.3%	25,352	33,719	38,328	42,402	46,453
Total VI		**480,257**	**560,524**	**619,665**	**716,426**	**799,064**
VI (% of >40s)		**5.4%**	**5.6%**	**5.8%**	**6.1%**	**6.5%**
50-59	0.1%	2,308	2,536	2,680	2,617	2,794
60-69	0.3%	4,644	6,010	6,978	7,779	8,276
70-79	0.7%	7,927	8,369	9,341	12,200	14,451
80-89	4.1%	24,717	30,486	33,239	37,344	42,058
90+	17.8%	10,952	14,567	16,559	18,319	20,069
Total blind		**50,548**	**61,969**	**68,795**	**78,259**	**87,648**
Blind (% of >40s)		**0.57%**	**0.62%**	**0.64%**	**0.67%**	**0.71%**

Source: Access Economics Pty Limited from VIP, BMES and ABS population data.

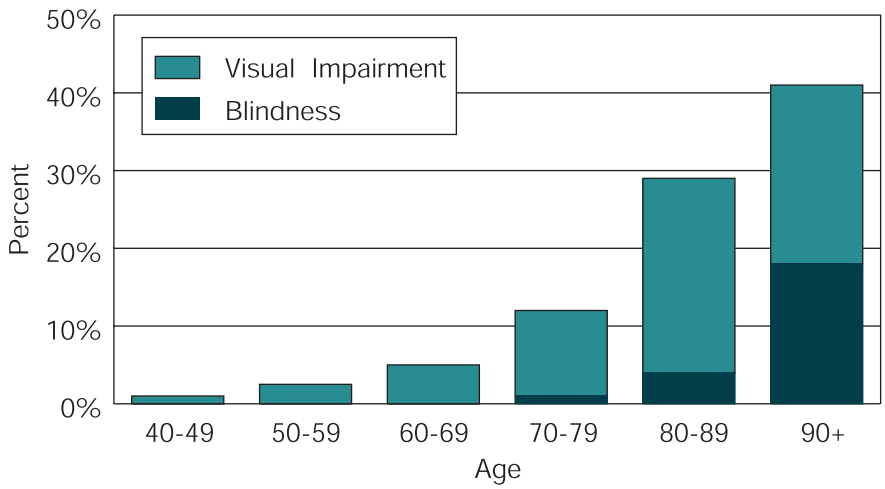
Summary of the impact of visual impairment

The prevalence of vision loss trebles with each decade over the age of 40.

The charts below, derived from the combined BMES and VIP data, illustrate:

- the age relationship of visual impairment and blindness (Figure 1-5);
- the large proportion (62%) of visual impairment caused by uncorrected refractive error (Figure 1-6 and Figure 1-7);
- the large proportion of both uncorrectable visual impairment (26%) and blindness (48%) caused by AMD (Figure 1-8 and Figure 1-9); and
- the growth in visual impairment and blindness over the coming decades (Figure 1-10).

Figure 1-5: Visual impairment and blindness, % age group, Australia, 2004



NB: Visual impairment <6/12; blindness <6/60.

Summary of the impact of visual impairment

Figure 1-6: Visual impairment due to refractive error by age, estimated numbers, Australia, 2004

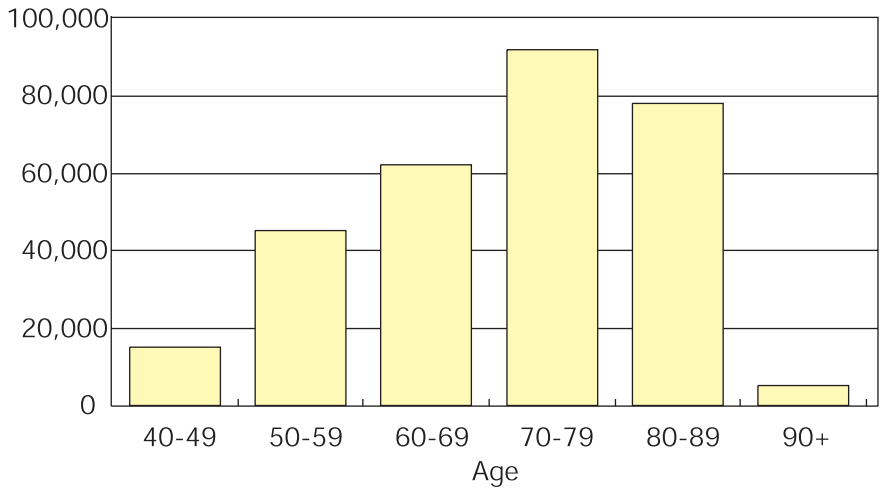
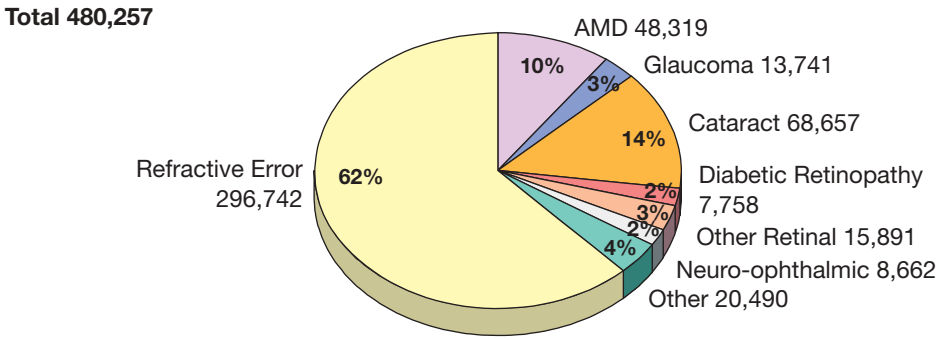
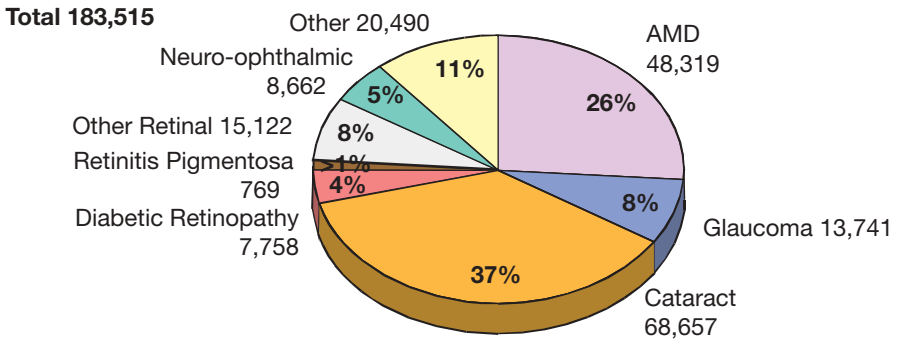


Figure 1-7: Visual impairment by cause in over-40s, Australia, 2004



Undercorrected refractive error is the leading cause of visual impairment.

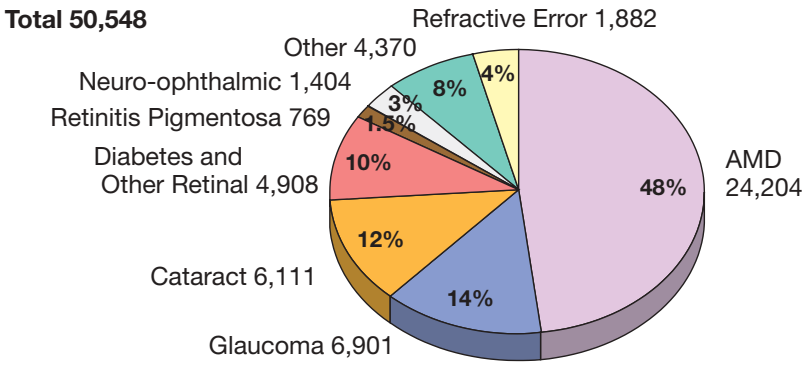
Figure 1-8: Visual impairment not correctable by refraction, by cause in over-40s, Australia, 2004



Summary of the impact of visual impairment

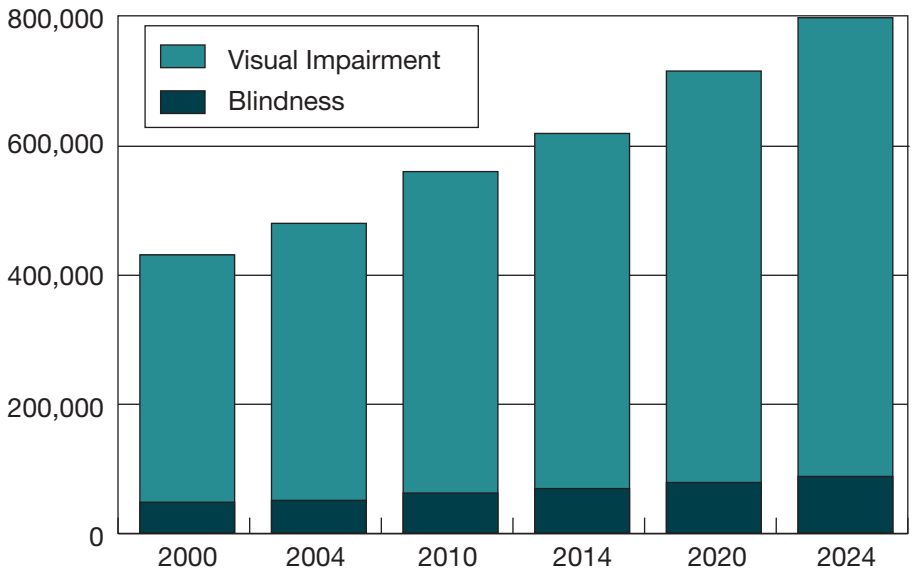
AMD is the leading cause of blindness.

Figure 1-9: Blindness by cause in over-40s, Australia, 2004



The number of Australians with blindness or visual impairment will nearly double over the next 20 years.

Figure 1-10: Prevalence of visual impairment and blindness, Australia, 2004-2024



Summary of the impact of visual impairment

1.6.2 Mortality and Comorbidity

Visual impairment increases the risk of death.

Mortality rates were estimated from VIP data as 2.34 (95% confidence interval, 1.03-5.32) times the average, based on approximately 5-year follow-up for urban participants (McCarty et al, 2001) and after standardising for age, male sex, smoking duration, duration of high blood pressure and arthritis. This was higher than the standardised mortality rates in the Blue Mountains or Beaver Dam studies, which also showed significantly elevated risk after controlling for other key variables - 70% (Wang et al, 2001a, 1.7 95% confidence interval, 1.2-2.3) and 8-67% (Klein et al, 1995, 95% confidence interval, 1.08, 0.77-1.61; 1.67, 1.18-2.08) higher respectively.[6]

Mortality rates for visually impaired people (not standardised) from VIP are shown relative to population averages for 1996 (ABS, 2002b, p48) for 10-year cohorts in Table 1-8, with the raw data showing that 4.3% of Australians aged 40 or more die, compared to 1.6% of 40+ Australians in total, a ratio of 2.63:1 (26.6 deaths per 1000 difference). Differences increase with age. The unstandardised odds ratio of death between those who have visual impairment and those who do not is thus 3.06 (with the risk of death for those 40 years or older who do not have VI derived as 1.4%).

Table 1-8: Mortality rates, average Australian and those with visual impairment

	VI/'000	Av/'000	Ratio	Difference
Males				
40-49	5.6	2.32	2.42	3.3
50-59	24.6	5.69	4.32	18.9
60-69	37.5	17.34	2.16	20.2
70-79	67.3	44.90	1.50	22.4
80+	220.7	129.64	1.70	91.1
Total	**37.7**	**17.44**	**2.16**	**20.3**
Females				
40-49	6.4	1.34	4.76	5.1
50-59	15.1	3.54	4.27	11.6
60-69	34.4	9.19	3.74	25.2
70-79	113.0	25.89	4.37	87.1
80+	310.3	99.50	3.12	210.8
Total	**47.2**	**15.15**	**3.12**	**32.1**
People				
40-49	6.1	1.83	3.30	4.2
50-59	19.4	4.63	4.20	14.8
60-69	35.9	13.20	2.72	22.7
70-79	90.1	34.33	2.62	55.8
80+	277.7	109.86	2.53	167.8
Total	**42.8**	**16.26**	**2.63**	**26.6**

[6] Re-running the VIP data to include visual impairment from refractive error (which was removed due to insignificance in the McCarty paper) reduces the odds ratio from 2.34 to 1.42.

Summary of the impact of visual impairment

Visual impairment decreases the quality and length of life. It increases morbidity and mortality.

The 'excess deaths' can be explained by a number of factors, given that it is unlikely poor vision can of itself directly cause death. The VIP, BMES and Beaver Dam studies all identify age and gender as significant explanatory variables. VIP, as noted above, found that smoking, high blood pressure and arthritis also contributed to deaths. The BMES identified low self-rated health, low socioeconomic status, systemic medical conditions (walking disability, history of cancer, diabetes, gout and stroke) and negative health risk behaviours (smoking, underweight). The Beaver Dam study identified history of CVD and cancer, current diabetes, high blood pressure, high cholesterol, high pulse rate, smoking, less activity, diuretic use and underweight as other explanations.[7] However, none of these studies were able to control for the proportion of excess deaths that may be attributable to other factors, such as falls, motor vehicle accidents and depression, for which there is evidence of correlation with visual impairment less than 6/12:

- twice the risk of falls (Ivers et al, 1998);
- four to eight times the risk of hip fractures (Klein et al, 1998 and Ivers et al, 2003); and
- three times the risk of depression (Rovner and Ganguli, 1998).

Without controlling for the contribution of other sources of morbidity and mortality, application of the odds ratios is likely to give over-inflated results. For example, suppose each of the odds ratios from the current studies are applied to the population of people with visual impairment in Australia in 2004; then between 7,467 and 15,891 deaths would be attributable to visual impairment. This would represent between 5% and 12% of all Australian deaths (all ages and causes), which seems implausibly high.

Thus, while there are good data ascertaining the correlation between higher mortality and visual impairment in populations with and without visual impairment, there is limited information that would be sufficient to ascribe an aetiological fraction to deaths attributable to visual impairment within the population of those who have visual impairment and die. The Australian Bureau of Statistics (ABS, 2003 and previous issues) publishes data on deaths that, in accordance with WHO guidelines, is attributed to an ICD-10 category as the 'underlying cause' of death, defined as:

> *"the disease or injury which initiated the train of morbid events leading directly to the death, or the circumstances of the accident or violence which produced the fatal injury".*

[7] There may be risk of multicollinearity between some of these variables, since CVD, diabetes and their biomedical risk factors are related.

Summary of the impact of visual impairment

Since its adoption in 1948, the underlying cause concept has been supplemented by data on concurrent or co-existing conditions, which are helpful where the initiating condition is difficult to isolate. The current data thus provide information on the immediate cause of death, as well as other intervening or contributory causes, transcribed from medical certificates using software developed by the US National Center for Health Statistics with the conversion in accordance with ICD coding rules. The ABS notes that the more sophisticated coding introduced since 1997 will

> *"facilitate policy relevant epidemiological and demographic research by focusing on competing risks and disease interactions" (ABS, 2003, p69).*

ABS mortality data for 'diseases of the eye and adnexa' as an underlying and one of multiple causes of death are only available for the years 1999-2002 inclusive. These data show, on average, a ratio of 120.9:1 between multiple and underlying causes for diseases of the eye and adnexa. The aetiological fraction thus derived is 0.83% ie, where people die who have eye disease as a contributing cause of death, 0.83% of those deaths can be said to be caused by the eye disease. The numbers suggest that in a year there are 332.5 Australians who have eye disease as one of multiple causes of death, while 2.75 have eye disease as the underlying cause of death. However, relative to the epidemiological studies showing higher risks (such as in Table 1-8 and the discussion above), these numbers seem implausibly low.

Standard errors within the age-gender groups in Table 1-8 are too high to predict the odds ratios or numbers of deaths with confidence at the disaggregated level. However, we can more confidently estimate the deaths for those under 65 with visual impairment as 2,206 (11% of total deaths for Australians aged 40-65) and those over 65 as 68,462 (69% of total deaths over 65). In total, of the 120,395 deaths in 1996 of Australians aged over 40, 70,668 (59%) had visual impairment.

The task remains to marry the VIP mortality and ABS causes of death data, since people with diseases of the eye and adnexa do not necessarily have visual impairment, and since having visual impairment does not necessarily cause or even contribute to death. Applying the attributable fraction of 0.83% to the 70,668 Australians who died and had visual impairment in 2004, suggests that 18 people aged 40-65 and 566 people aged over 65 - 584 Australians in all - died as a result of visual impairment.

For 2004 we estimate that 584 Australian deaths are attributable to visual impairment.

1.6.3 Service Utilisation

Keeffe et al (2002) show there are differences in the use of eye care services, with gender, urban residence, need, private health insurance and conversing in English significantly associated with eye healthcare service use. Results are summarised in Table 1-9.

Age and gender: Data from the VIP study showed that use of eye care services was strongly age-related, with visits to both optometrist and ophthalmologist increasing from 22% at age 40-49 to 57% by age 80+. Conversely, never having visited an eye care provider fell from 24% to 2% over the same age range. Men were significantly more likely to never visit an eye care provider (11% compared to 8% for women).

Rurality: Living in a rural area increased the likelihood of seeing an optometrist rather than an ophthalmologist and increased the likelihood of never seeing an eye care provider. People in the bush were more likely to see only an optometrist (60% compared to 39% in urban areas), while those in urban areas were more likely to see an ophthalmologist only (15% compared to 2%) or both (40% compared to 25%). Rural Australians were almost twice as likely to never see an eye care provider (13% compared to 7%).

Private insurance: Having private health insurance (PHI) increased the likelihood of seeing an ophthalmologist but not an optometrist. People with PHI were more likely to visit both (39% compared to 29%), or an ophthalmologist only (12% compared to 9%), while those without PHI were more likely to visit an optometrist only (50% compared to 41%). Having PHI also reduced the likelihood of never being checked by an eye care provider (7% compared to 11%).

Language: People speaking Greek, Italian or other languages were about half as likely to have seen both an ophthalmologist and optometrist, and were more likely to have never seen an eye care provider. However, overall rates of vision loss or the major eye diseases were not related to ethnicity.

Education and employment: There was no significant difference in service utilisation between people who were employed and those who were unemployed. There was an increased likelihood for people without tertiary qualifications to visit an optometrist, compared to tertiary-educated Australians who were more likely to visit an ophthalmologist or both.

Presence of an eye condition: Lower visual acuity and the presence of eye disease were both associated, as expected, with a higher use of 'both' services, a lower use of optometrist only services and a lower chance of never using eye care services.

Summary of the impact of visual impairment

Table 1-9: Univariate association of factors with use of eye care services

	Optometrist only	Ophthalmologist only	Both	Neither
Gender				
Male	46	10	33	11
Female	45	11	36	8
Age				
40-49	44	10	22	24
50-59	51	11	33	5
60-69	47	11	39	2
70-79	41	11	46	2
80+ years	26	13	57	2
Residence				
Urban	39	15	40	7
Rural	60	2	25	13
PHI				
Yes	41	12	39	7
No	50	9	29	11
Language				
English	45	10	36	9
Asian	38	19	36	7
Greek	45	18	25	12
Italian	49	12	30	8
Other European	57	14	25	4
Other	47	16	22	16
Education				
No secondary	47	11	35	8
Secondary	45	11	33	11
Trade	54	5	31	11
Tertiary	37	14	40	9
Employment				
Employed	48	10	29	13
Unemployed	48	14*	29	9
Home duties	46	10	37	7
Retired	41	13	42	3
Other	42	11	36	11
Presenting acuity				
>=6/6	47	10	32	11
<6/6	41	12	41	5
Eye disease**				
Yes	39	12	46	3
No	49	10	30	12

Source: Keeffe et al (2002), Table 1 (Table 2 gives multivariate).
**n=11 only. ** Cataract, AMD, glaucoma.*

Data show a higher use of social services and admission to nursing homes for people with visual impairment.

1.6.4 Employment and other socioeconomic impacts

Employment rates are lower for people with visual impairment and unemployment rates higher, as derived from VIP data (special data request). For people aged 40 to 64 years, the employment rate was 34.5% and the unemployment rate 6.4%, compared to 68.8% and 3.8% respectively for all 40-64 year olds in Australia. For people 65 and over with visual impairment, the employment rate was 2.0% and the unemployment rate 0.0%, compared with 6.5% and 0.8% for all 65+ Australians. These data are standardised in Section 3.1.1.

Another impact of visual impairment identified in the Salisbury Eye Study was increased social isolation, including double the difficulties with daily living, ease of social functioning reduced by half and religious participation reduced by half (Valbuena et al, 1999). Emotional distress is also apparent in people with retinal disease (Scot et al, 2001).

Data from both the Blue Mountains Eye Study and the Melbourne Visual Impairment Project show a higher use of social services and of admission to nursing homes for people with visual impairment (Wang et al, 1999; VanNewkirk et al, 2000; Wang et al, 2003). McCarty et al (1998) examine the use of eye care services by people with diabetes, while Livingston et al (1998) present findings on self-care practices and Weih et al (2000) discuss the functional implications of visual impairment. Livingston et al (1997) summarise the socioeconomic impacts of visual impairment.

2. Direct costs to the Australian people

Costs associated with visual impairment are traditionally, and fairly loosely, defined as either direct or indirect.

- **Direct financial costs to the Australian health system include the relevant proportion of the costs of running hospitals and nursing homes (buildings, care, consumables), GP and specialist medical services, the cost of prescription pharmaceuticals (PBS and private) and of other medications, allied health services, research and "other" direct costs (such as administration).**

- **Indirect costs (addressed in Chapter 3) include productivity losses (income forfeited due to early retirement, absenteeism and premature mortality), the value of informal care, equipment and aids that are required to help cope with illness, as well as the pain, suffering and premature death that results from visual impairment and blindness.**

In this chapter, the direct costs of visual impairment have been based on data drawn from the Australian Institute of Health and Welfare (AIHW) - see Methodology.

Conservatively, where costs are categorised as being due to falls, fractures, motor vehicle accidents or depression, we have not partially attributed those costs to visual impairment even though it may well have contributed in some way to the misadventure. Our attributable fraction of 0.83% for mortality might in future be allocated between such sequelae, when epidemiological evidence of causal pathways is stronger.

Direct costs data were provided specially by the AIHW for the years 1993-94 and 2000-01. The 2000-01 data have been converted to 2004 prices using health cost inflation data from AIHW (2003) - 3.2% for 2000-01 to 2001-02 and 2.8% per annum thereafter, together with estimates of growth in the prevalence of visual impairment based on population growth in each age group.

It should be noted that while the prevalence data related to visual impairment specifically, the cost data refer to disorders of the eye and adnexa. Moreover, the categories for which data are available vary between 1993-94 and 2000-01 (2004), and for the latter only 86% of total recurrent health expenditure is included - the excluded categories are capital expenditures, expenditure on community health, public health programs, health administration and health aids and appliances. The exclusion of these might be expected to have particularly strong impacts on hospital and residential aged care costs. Careful interpolation is thus required, especially in comparing between the two periods.

2.1 Direct health costs in 1993 - 94

In 1993-94, cataract was the highest health expenditure eye care item.

Costs in 1993-94 for all disorders of the eye and adnexa totalled $838.9m. The composition of costs is illustrated in Figure 2-1 and Figure 2-2. Key points are summarised below.

- Hospital costs accounted for nearly half of costs - $387.0m (46.1% of total costs).
- Next largest were specialist costs at $123.7m (14.7%) and nursing homes at $118.2m (14.1%).
- Other health practitioners accounted for 6.5% of total costs, pharmaceuticals 6.1%, GPs 5.6% and research 2.6%.
- Cataract was the largest cost condition - $345.4m (41.2%).
- Because costs for macular degeneration or diabetic retinopathy were not able to be separately identified, the 'other conditions' category is large at 32.4%.
- Conjunctivitis cost $100.1m (11.9%); refractive error $53.2m (6.3%) and glaucoma $40.6m (4.8%).
- The cost of blindness was $14.1m (1.7% of total costs).

Figure 2-1 Cost of diseases of the eye and adnexa, 1993-94, $m, by cost type

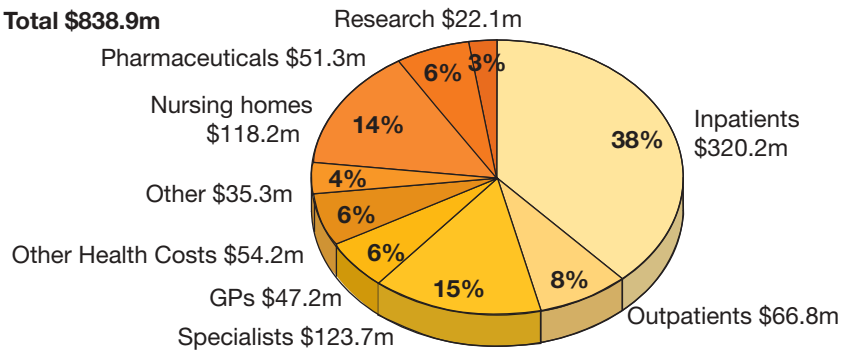
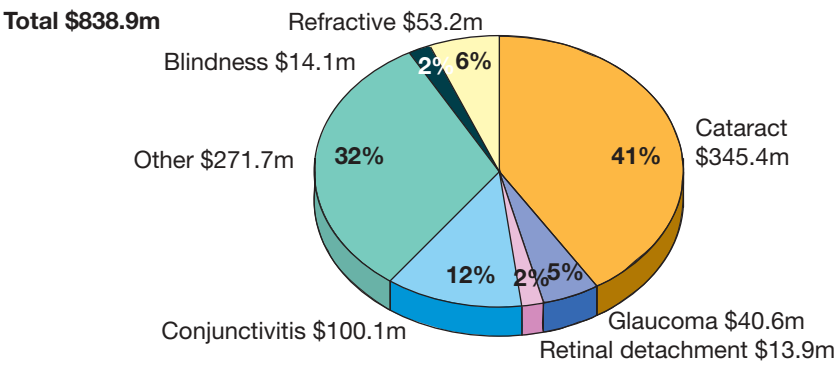


Figure 2-2 Cost of diseases of the eye and adnexa, 1993-94, $m, by condition



Direct health costs in 1993 - 94

Total costs of eye care increase in older age due to higher prevalence.

The age distribution of costs in 1993-94 is illustrated in Figure 2-3 and Table 2-1. Unfortunately the data for 1993-94 for those over 75 were not able to be further disaggregated, in particular to separate those aged over 85, although this is possible and is done for the more recent data.

- As expected, total costs rise with age, with people aged 75 and over accounting for 36.7% of total costs and people 65-74 a further 21.0%.
- Females aged 75 and over accounted for 26.9% of all costs ($225.7m). Overall females incurred 60% and males 40% of total costs.
- The average cost of diseases of the eye or adnexa per person with visual impairment (estimated for June 1994) was $1,847 in 1993-94 dollars.

Greater detail for 1993-94 is provided in the Appendix tables - including breakdowns by age and gender.

Figure 2-3: Cost of diseases of the eye and adnexa, 1993-94, $m, by age and gender

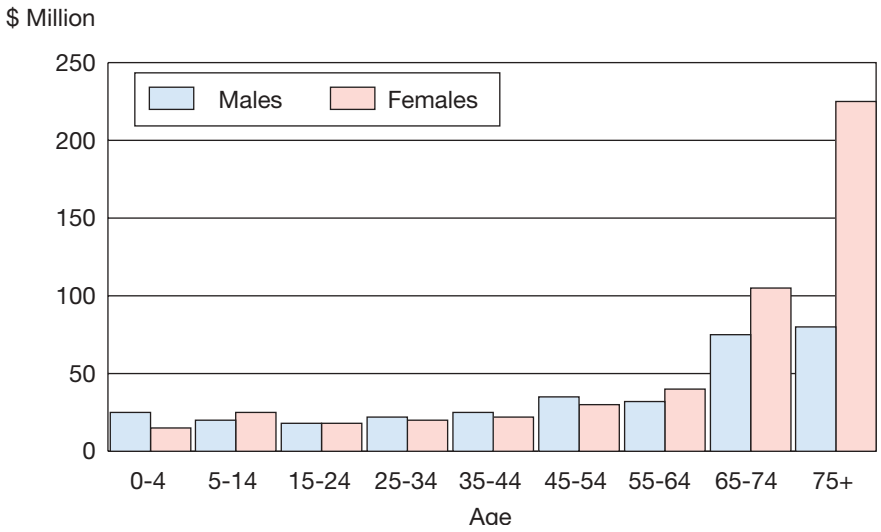


Table 2-1: Costs of eye disease, per person with visual impairment, 1993-94

	Cost $'000	People with VI,	Cost / person ($)
40-49	65,082	16,788	3,877
50-59	75,993	38,501	1,974
60-69	95,026	65,280	1,456
70-74	122,575	47,994	2,554
75+	308,174	192,436	1,601
Total	**666,850**	**360,999**	**1,847**

2.2 Direct health costs in 2004

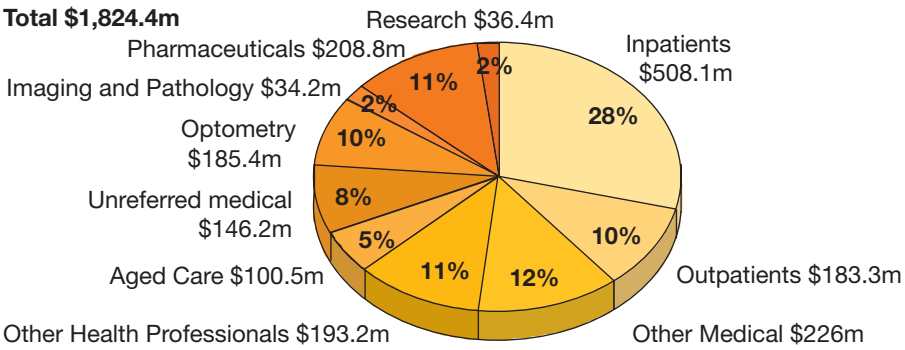
In 10 years the costs of eye disease have more than doubled.

Costs in 2004 for all disorders of the eye and adnexa are estimated to total $1,824.4m - 2.17 times the 1993-94 costs. The composition of costs is illustrated in Figure 2-1 and Figure 2-2. Key points regarding types of costs are summarised below.

- Hospital costs have grown substantially in dollar terms, to $692.0m, and remain the largest cost item.
  - The relative share of hospital costs in 2004 is 37.9% of total costs, compared to 46% in 1993-94, which may be due in part to the exclusion of capital costs in the recent data.
  - Probably for similar data incomparability reasons, the share of residential aged care is 5.5% (rather than 14%).
- Specialists and other out-of-hospital referred medical costs remain second largest at $226.0m (12.4%), their share falling slightly since 1993-94.
- The share of pharmaceutical costs has increased to 11.4% of the total ($208.8m) and of 'other health practitioners' similarly to 10.6% ($193.2m).
- Optometry, not included separately in 1993-94, is estimated at $187.1m in 2004 (10.3%), allocated entirely to refractive error.
- Unreferred attendances (mainly GPs) have increased in share to 8%.
- Pathology and imaging, new categories, are 2% together.
- Research is estimated to have fallen from 2.6% of the total ($22.1m in 1993-94 dollars) to 2.0% ($36.4m in 2004 dollars).
  - Public sector research for vision, hearing and speech has fallen steadily from 3.7% of total public sector health R&D spending in 1992-93 to 2.7% by 2000-01 (Access Economics Pty Limited, 2003). Public funding is about 65% of total funding for vision R&D (ie, twice the private sector), and includes NHMRC grants for 59 vision-related R&D projects in 2002 worth $7.6 million, a Cooperative Research Centre Grant (CRC) for vision from 2003 of $A32 million over seven years, and various other smaller University and State/Territory-funded projects.
  - In comparison, the United States spent US$653 million on health R&D for the National Eye Institute (<www.eyeresearch.org/naevr/advances.html> for June 2004); converting to Australian dollars at purchasing power parity (0.72841 for 2003), this suggests over eight times the per capita spending for the NEI compared to the NHMRC for vision R&D.

Direct health costs in 2004

Figure: 2-4: Cost of diseases of the eye and adnexa, 2004, $m, by cost type

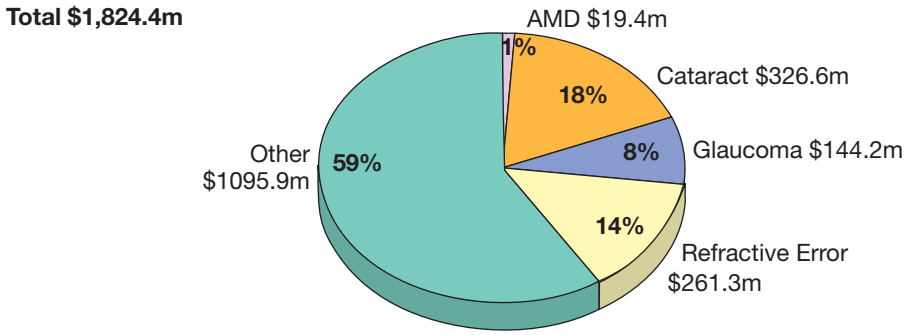


Key features of the composition of costs by condition are highlighted below.

- While still remaining the largest single category, the cost share of cataract has fallen significantly from 41.2% to 17.9% of the total - $326.6m.
  - However, the 2004 cataract data excludes residential aged care, which had $86.6m of costs allocated to it in 1993-94. This explains the fall in dollar terms from $345.4m to $326.6m.
  - Excluding these aged care (nursing home) costs from the 1993-94 data, the cost of cataract has increased by 26% over the period, although this is still smaller than might be expected, given increases in prevalence, services and general health inflation over the period.
  - The implication is that the cost per cataract case has declined to $4,778 in 2004 from $5,157 in 1993-94 (excluding residential aged care costs for both years, as well as the various costs excluded from the 2004 only data).
- Refractive error has increased substantially in cost over the period - to $261.3m (14.3% from 6%). The cost of glaucoma has also increased - to $144.2m (7.9% from 5%). However, while residential care costs are able to be included in the glaucoma estimate, this has not been possible for refractive error.
- Costs for macular degeneration also exclude residential care, but other direct costs are now able to be separately identified, unlike in 1993-94 - $19.4m (1.1% of total costs).
- Cost for diabetic retinopathy are still not able to be separately identified. They thus continue to be included in the very much larger 'other' category (58.8% of the total), together with conjunctivitis, blindness, and other eye conditions.

The costs of AMD may increase sharply as new treatments become available.

Figure 2-5: Cost of diseases of the eye and adnexa, 2004, $m, by condition



The direct costing above does not take into account the recent impacts of a special program announced in the 2002-03 Federal Budget, to provide funding for a new medical service, **photodynamic therapy with verteporfin (`Visudyne Therapy')**, to treat age-related macular degeneration. Visudyne Therapy can halt deterioration in vision for some people with AMD, thus enabling independent living for longer. The unit cost of Visudyne as at May 2002 was $2,100 per treatment plus the medical fee. Patients may need up to ten treatments over a two to three year period. Under the Budget measure, patients are able to access the therapy under Medicare and Veterans' Benefits arrangements, with access limited to those who may benefit (as per a special Determination under the *Health Insurance Act 1973*).

Federal costs for this initiative of around $30-40m per annum were estimated in May 2002 as shown in Table 2-2. Hence AMD costs are likely to be at least around three times the $19m shown above, estimated from extrapolation of the 2000-01 data.

Table 2-2: Visudyne Therapy federal cost estimates, 2002-03 to 2005-06, $m

	2002-03	2003-04	2004-05	2005-06
Department of Health and Ageing	23.8	29.6	26.6	24.8
Department of Veterans' Affairs	7.9	9.9	8.9	8.3
Total	**31.7**	**39.5**	**35.5**	**33.1**

Source: Costello and Minchin (2002).

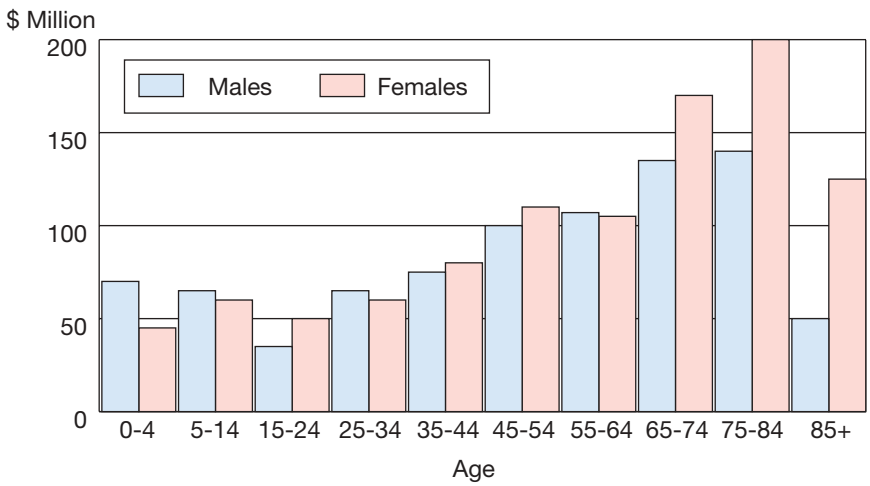
Direct health costs in 2004

The rising age distribution of costs in 2004 is illustrated in Figure 2-6 and Table 2-3 Table 2-1, this time with costs for people aged 85 and over able to be identified (compared to just those over 75 for 1993-94).

- In 2004, those aged 85 and over represented 9.3% of total costs, with those 75-85 the largest share - 18.6% and those 65-75 a further 16.2%.
- Females aged 75 and over accounted for 17.5% of all costs ($319.3m). Overall, females incurred 54.4% and males 45.6% of total costs.
- The average cost of diseases of the eye or adnexa per person with visual impairment (estimated for June 2004) was $2,762 in 2004 dollars.
  - Cost falls from $9,443 per person aged 40-49 to $1,612 for Australians aged 85 and older.
  - A large part of this effect is probably due to the inclusion of people with well-managed disorders, and hence no visual impairment, in the younger age groups.
- Surprisingly, the data suggest that the cost share of people aged 75 and over has fallen from 36.7% of the total in 1993-94 to 27.9% in 2004.
  - This may in part reflect the inclusion of new cost items (eg, optometry), which may have changed the overall age distribution.
  - It is also likely to reflect the exclusion of 14% of cost items in 2004, in particular capital components that may be associated more with hospitals and aged care facilities and thus associated with older people.
  - We again caution wariness in trying to draw too many conclusions from comparison of the two series of data.

Greater detail for 2004 is provided in the Appendix tables - including breakdowns by age and gender.

Figure 2-6: Cost of diseases of the eye and adnexa, 2004, $m, by age and gender



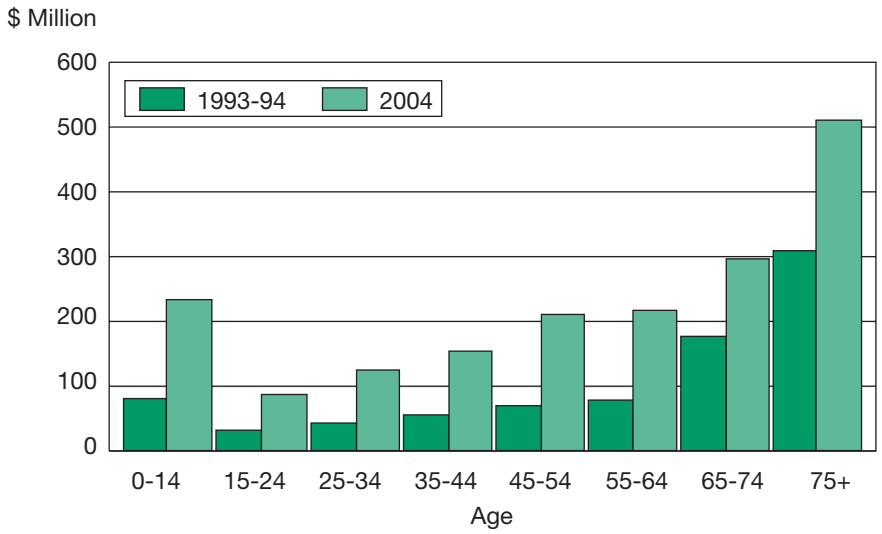
The costs of eye care have increased for all ages.

Table 2-3: Costs of eye disease, per person with visual impairment, 2004

	Cost $m	People with VI	Cost/ person ($)
40-49	187	19,753	9,443
50-59	227	57,496	3,943
60-69	234	73,153	3,195
70-79	329	132,201	2,491
80-84	182	92,953	1,954
85+	169	104,702	1,612
Total	**1,327**	**480,257**	**2,762**

Figure 2-7 shows the increase in costs over the decade to 2004, noting that only 86% of the health costs included in the 1993-94 figures are included in 2004, so the increase is understated.

Figure 2-7: Cost of diseases of the eye and adnexa, 1993-94 and 2004, $m, by age



2.3 Projections to 2020

The projections in this section are based on health inflation and demographic prevalence projections, driven in large part by the phenomenon of demographic ageing. While the demographic element is relatively reliable, the health inflation estimate is based on trend health inflation from the past decade, which is subject to considerable potential change in the future.

- Health technologies are changing rapidly, as are population expectations, such that, for example, surgical procedures and specialist services for eye care may experience substantial price swings over a medium to long term time horizon.
- Even demographic ageing may not provide a reliable basis for projections, if research or prevention activities, for example, were to reduce age-specific incidence and/or prevalence rates for visual disorders.

The following projections should thus be treated with caution, indicative only of a continuation of current trends.

- Section 1.6.1 shows that the number of people with visual impairment increases by 49% by 2020, although the total population increase is only 13% (all ages), due to the prevalence of visual impairment in older populations.
- Three scenarios for future projections of spending per person are simulated below:
  - **Low:** Assumes that spending per person will increase variably between each major cost category in accord with AIHW (2003) estimates for the distribution of real growth over the decade 1991-92 to 2001-02 (Table 15) applied to historical average inflation for the period 1997-98 to 2001-02 (Table 4) - 2.8% on average. In the former case, the whole decade is used so that the recent spike in pharmaceutical growth is not unduly pronounced.
  - **Medium:** Assumes that spending per person will increase on average by 2.8% across all cost categories.
  - **High:** Assumes that spending per person will reflect real increases in volumes of services, as well as prices, because health services are income-elastic goods (people demand more eye care services over time as their incomes increase) and expectations change. Future growth in each cost category is assumed to be as per Table 15 of AIHW (2003).
  - The scenarios are summarised in Table 2-4.

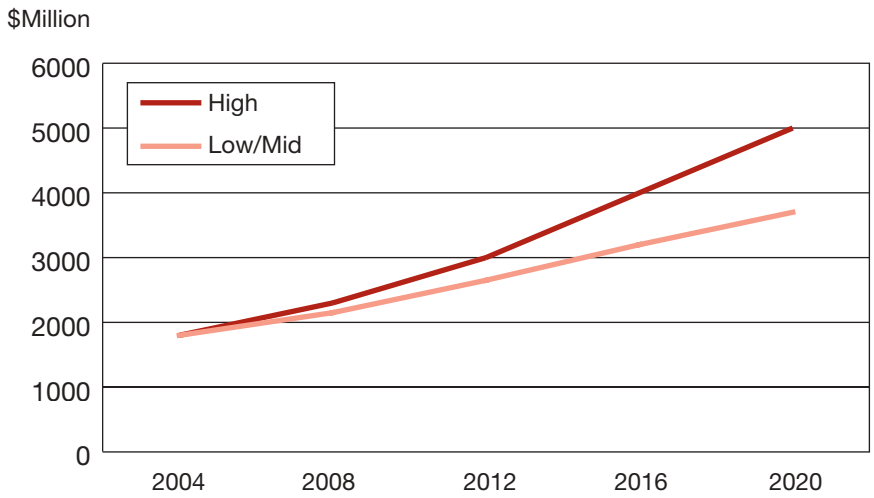
Table 2-4: Increases in health spending per person, scenarios 2004-2020, %PA

	Hospitals	Aged care	Pharma.	Medical services	Other prof. services	Other	Total
Low	2.5	1.6	6.0	2.4	1.6	2.7	2.8
Mid	2.8	2.8	2.8	2.8	2.8	2.8	2.8
High	4.0	2.6	9.6	3.8	2.5	4.4	4.5

Costs of eye care will continue to increase faster than the population because of the increasing proportion of older people.

Results indicate costs by 2020 for the low and mid scenarios that are very similar - $3,723.0m and $3,731.5m respectively, more than double (2.07 times) the current spend. The high scenario suggests projected health costs of $4,942.4m by 2020, 2.74 times the current spend (Figure 2-8).

Figure 2-8: Projections of health expenditure for eye care, 2004-2020, $m



Projections for each of the types of costs are illustrated in Figure 2-9, with the changes highlighted in Figure 2-10.

- The 'high' and 'low' scenarios are dominated by increases in pharmaceutical costs, reflecting their overall increase in recent years, which may not continue and may not relate particularly well to eye care treatments.
- The 'mid' scenario suggests that future spending growth will focus on hospitals and aged care, which we believe is most likely, and hence suggest the use of this scenario as the 'base case'.
  - In this scenario, hospital costs for people with visual disorders are projected to increase from $692m in 2004 to $1.45bn by the end of next decade.
  - Out of hospital medical costs would increase from $406m to $820m.
  - Pharmaceutical costs would increase from $209m to $436m, optometry from $187m to $352m and aged care from $101m to $244m.

Figure 2-9: Projections, by type of cost and scenario, 2004-2020, $m

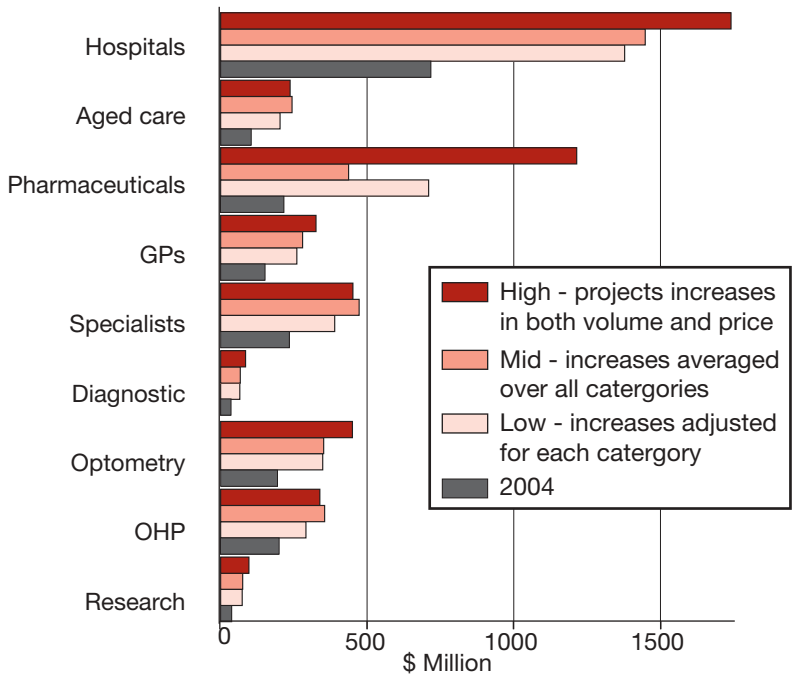
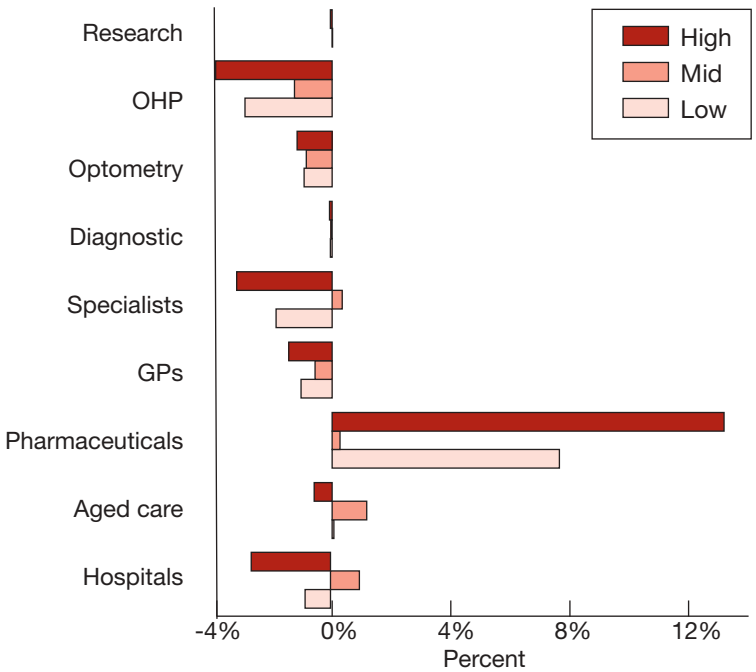


Figure 2-10: Projections, changes in type of cost by scenario, 2004-2020, % total



The age distribution of costs shows strongest growth for those aged 65-74 years - increasing from 16.4% now to 22.3% in the high scenario, with lesser impacts in the other two scenarios (Table 2-5). The lowest impact on age is actually in the 'middle' scenario (base case) - showing this age group's share still rises to 21.6%.

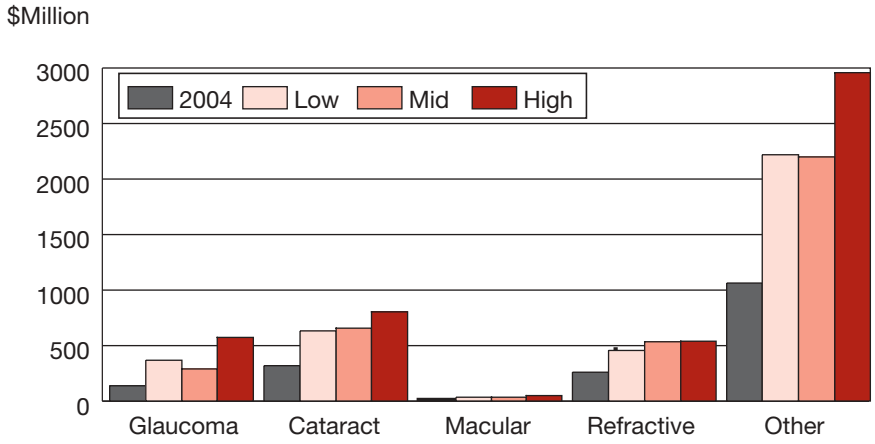
Table 2-5: Projections, health spending by age, 2004 and 2020, % total

	2004	Low 2020	Mid 2020	High 2020
0-4	6.3%	4.4%	4.6%	4.3%
5-14	6.6%	4.5%	4.6%	4.4%
15-24	4.8%	3.6%	3.6%	3.6%
25-34	6.9%	5.3%	5.3%	5.3%
35-44	8.5%	6.6%	6.5%	6.6%
45-54	11.6%	9.9%	9.8%	9.9%
55-64	11.9%	12.8%	12.7%	12.9%
65-74	16.4%	22.1%	21.6%	22.3%
75-84	18.9%	19.9%	19.4%	20.1%
85+	9.3%	11.0%	11.7%	10.6%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Projections for each of the various eye disorders are illustrated in Figure 2-11. For the base case (mid scenario):

- Glaucoma costs are projected to increase from $144m to $289m.
- Cataract costs are projected to increase from $327m to $660m.
- AMD costs are projected to increase from $19m to $40m.
- Costs of refractive error are projected to increase from $261m to $535m.
- Other eye care costs are projected to increase from $1,073m to $2,194m.

Figure 2-11: Projections, by eye disorder and scenario, 2004-2020, $m



2.4 Comparisons with other disorders

The size of health spending on eye care is very substantial, more than the spending on coronary heart disease, stroke, arthritis or depression. Official data from 2000-01 have been used in order to make these comparisons (Table 2-6).

Eye care costs more than coronary heart disease, stroke, arthritis and depression.

- Compared to other national health priorities, the health costs of vision disorders ($1,584 in 200-01) are more than of diabetes ($836m) and asthma ($615m) combined.
- Eye care represents 3.2% of total Australian spending on health, and nearly 5% of national spending on medical and other health practitioners (OHPs).

The relative size of spending on health compared to the seven national health priorities (NHPs), is shown in Figure 2-12.

- The NHPs are cardiovascular disease (including ischaemic or 'coronary' heart disease), musculoskeletal disease (including arthritis), injuries, mental disorders (including depression), cancer, diabetes and asthma.

Table 2-6: Health cost comparison, national priorities and other, 2000-01, $m

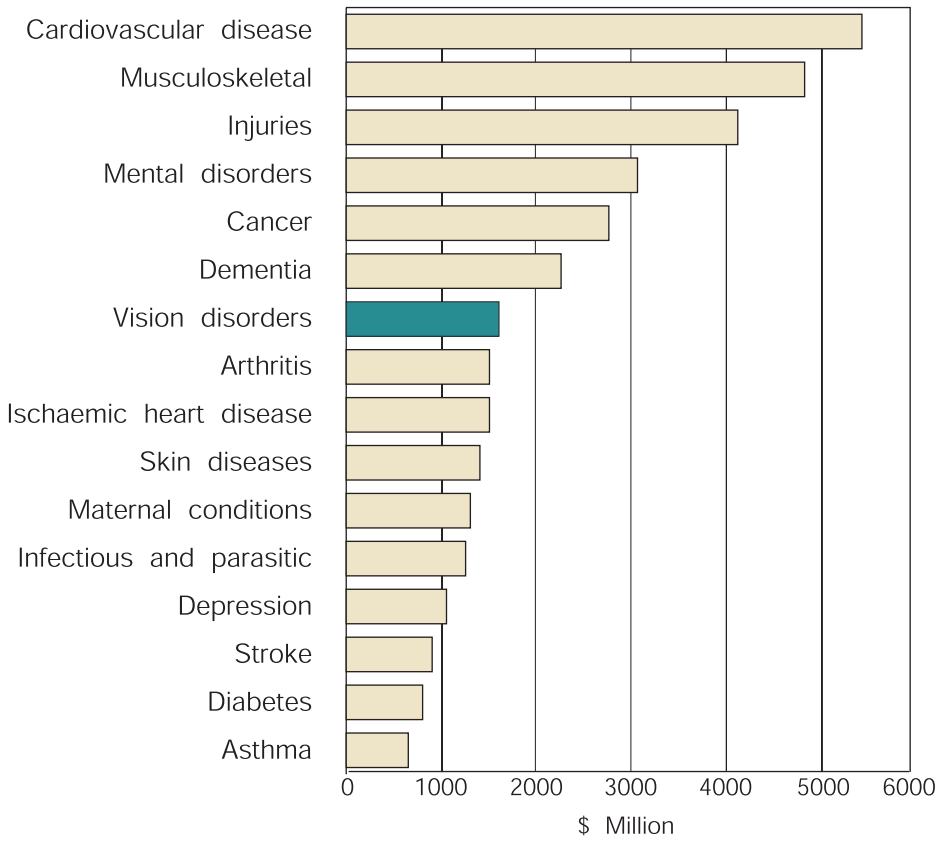
Disease category	Total costs	Hospital & aged care	Medical & OHPs	Pharma	Research	% total hlth spend
Cardiovascular disease*	5,393	3,059	794	1,386	153	11.0%
Ischaemic heart disease	1,488	1,145	116	183	44	3.0%
Stroke	922	834	38	30	20	1.9%
Musculoskeletal*	4,725	2,310	1,669	691	55	9.6%
Arthritis						
Injuries*	4,061	2,935	931	190	6	8.3%
Mental disorders*	3,018	1,561	733	615	109	6.1%
Depression	1,042	349	353	302	38	2.1%
Cancer*	2,764	2,025	297	226	215	5.6%
Dementia	2,251	2,077	29	33	112	4.6%
Visual disorders	**1,584**	**686**	**686**	**180.9**	**31.5**	**3.2%**
Skin diseases	1,392	575	453	351	13	2.8%
Maternal conditions	1,318	1,178	119	10	11	2.7%
Infectious & parasitic	1,251	486	393	233	139	2.5%
Diabetes*	836	327	223	251	35	1.7%
Asthma*	615	196	123	290	6	1.3%
Other**	19,966	8,514	7,528	3,628	296	40.6%
Total	**49,174**	**25,929**	**13,978**	**8,085**	**1,182**	**100.0%**
Vision as % of total	**3.2%**	**2.6%**	**4.9%**	**2.2%**	**2.7%**	

The health costs of vision disorders are more than diabetes and asthma combined.

** National health priorities. ** "Other" includes other major disease chapters, such as digestive, genitourinary and oral health, as well as numerous smaller items such as congenital abnormalities and the variety of signs, symptoms, and ill-defined conditions generating other contact with the health system.*
Source AIHW (2004).

The costs of eye disease may warrant closer attention on the national health agenda.

Figure 2-12: Health cost comparison, national priorities and other, 2000-01, $m



Section 3.3 discusses the substantial impact of the disease burden (suffering and premature death) due to visual disorders - and also makes revealing comparisons with other national health priority areas.

2.5 International comparisons

Estimates by the World Health Organisation indicate that there are approximately 35 million people in the world who are blind, 90% of whom live in developing countries. In addition, there are twice as many with low vision.

Australia has better data on the prevalence of eye disease than any other country.

2.5.1 United States

Visual impairment in the US is defined as visual acuity worse than 20/40 in the better eye, with corrective eyewear. Blindness is defined as a visual acuity equal to or worse than 20/200 in the better eye, with best correction, or a visual field of less than 20 degrees.

Blindness or low vision affects 3.3 million Americans aged 40 and over, or 1 in 28. representing 3.6% of the over-40 population in 2000. This figure is projected to reach 5.5 million by the year 2020. People 80 years and older make up 8% of the population, but account for 69% of blindness (Coogan, 2004). Females are more affected than males (Prevent Blindness America, 2002). According to Garnett (1999), one American becomes blind or severely vision impaired every 11 minutes, with 47,000 Americans becoming blind every year.

Coogan (2004) reports the findings from the source studies (which appear in the April 2004 issue of Archives of Ophthalmology) investigated by the Eye Disease Prevalence Research Group, a consortium of principal investigators who have conducted population-based eye disease studies and produced prevalence estimates of blindness and low vision in people age 40 and over by analysing the standardised data from the source studies, applying them to the US population using 2000 census data, and projecting to 2020 based on 2020 US census estimates. Key findings are summarised in Tables 2-7 to 2-10.

- Cataract is the leading cause of low vision among all Americans, responsible for about 50 percent of all cases.
- AMD is strongly associated with increasing age, particularly after age 60. AMD rises dramatically in whites over age 80; more than one in 10 white Americans over age 80 has vision loss from AMD.
- Glaucoma is almost three times as common in African Americans as in whites.
- The prevalence of glaucoma rises rapidly in Hispanics over age 65.
- One in every 12 people with diabetes age 40 and older has vision-threatening diabetic retinopathy.

In Australia trends in eye disease mirror those in the US and UK.

Table 2-7: Prevalence and projections of eye disease, US adults 40 and over

	Current estimates (m)	2020 projections (m)
Advanced Age-Related Macular Degeneration		
(with associated vision loss)	1.8*	2.9
Glaucoma	2.2	3.3
Diabetic retinopathy	4.1	7.2
Cataract	20.5	30.1

Source: Coogan (2004) based on Archives of Ophthalmology, Vol 122, April 2004.

* Another 7.3 million people are at substantial risk for vision loss from AMD.

Table 2-8: Prevalence of cataract, AMD and open-angle glaucoma, adults 40 years and over, United States, 2000

Age	Cataract		Advanced AMD		Intermediate AMD		Glaucoma	
Years	Persons	(%)	Persons	(%)	Persons	(%)	Persons	(%)
40-49	1,046,000	2.5	20,000	0.1	851,000	2.0	290,000	0.7
50-59	2,123,000	6.8	113,000	0.4	1,053,000	3.4	318,000	1.0
60-69	4,061,000	20.0	147,000	0.7	1,294,000	6.4	369,000	1.8
70-79	6,973,000	42.8	388,000	2.4	1,949,000	12.0	530,000	3.9
≥ 80	6,272,000	68.3	1,081,000	11.8	2,164,000	23.6	711,000	7.7
Total	**20,475,000**	**17.2**	**1,749,000**	**1.5**	**7,311,000**	**6.1**	**2,218,000**	**1.9**

Source: Coogan (2004) based on Archives of Ophthalmology, Vol 122, April 2004.

Table 2-9: Prevalence of diabetic retinopathy among adults, United States, 2000

	Type 1 Diabetes		All Diabetes - 40 Years and Older	
Years	Persons	(%)	Persons	(%)
18-39	278,000	0.3	NA	
40-49	172,000	0.4	589,000	1.4
50-64	317,000	0.4	1,582,000	3.8
65-74			1,068,000	5.8
≥ 75			824,000	5.0
Total	**767,000**	**0.4**	**4,063,000**	**3.4**

Source: Coogan (2004) based on Archives of Ophthalmology, Vol 122, April 2004.

International comparisons

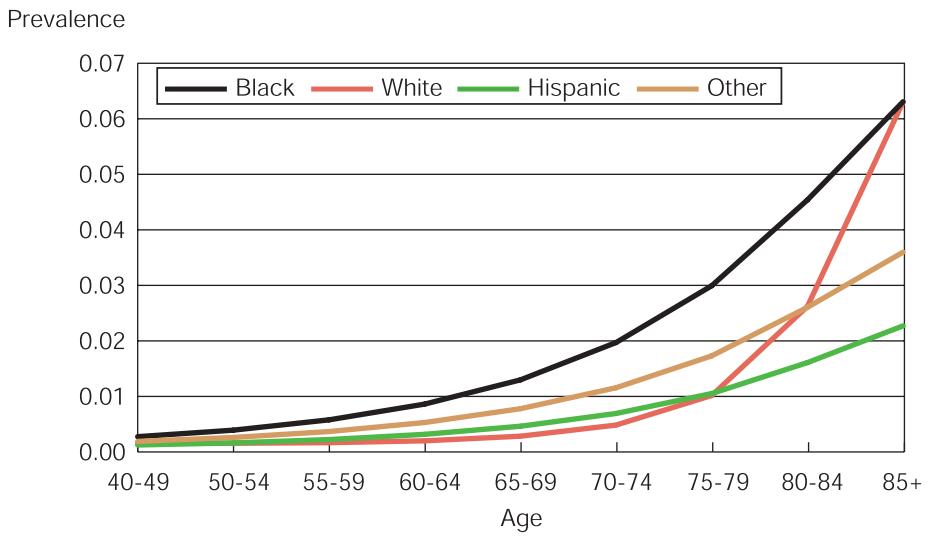
Table 2-10: Prevalence of blindness and low vision, adults 40 years and over, United States, 2000

	Blindness		Low Vision		All Vision Impaired	
Years	**Persons**	**(%)**	**Persons**	**(%)**	**Persons**	**(%)**
40-49	51,000	0.1	80,000	0.2	131,000	0.3
50-59	45,000	0.1	102,000	0.3	147,000	0.4
60-69	59,000	0.3	176,000	0.9	235,000	1.2
70-79	134,000	0.8	471,000	3.0	605,000	3.8
≥ 80	648,000	7.0	1,532,000	16.7	2,180,000	23.7
Total	**937,000**	**0.8**	**2,361,000**	**2.0**	**3,298,000**	**2.7**

Source: Coogan (2004) based on Archives of Ophthalmology, Vol 122, April 2004.

Age is a significant contributing factor, as illustrated in Figure 2-13 for blindness. Prevalence rates increase considerably after the age of 75, across all cultural backgrounds. Figure 2-14 provides more detail by disease.

Figure 2-13: Prevalence of blindness by age, US, 2000

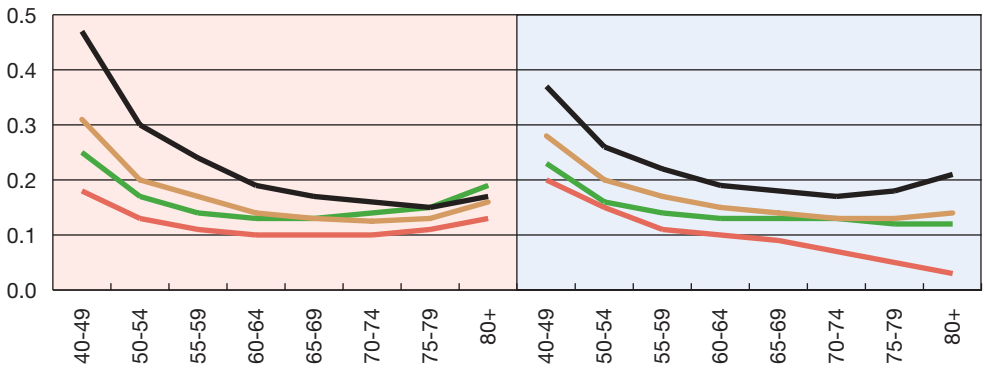


White
Black
Hispanic
Other

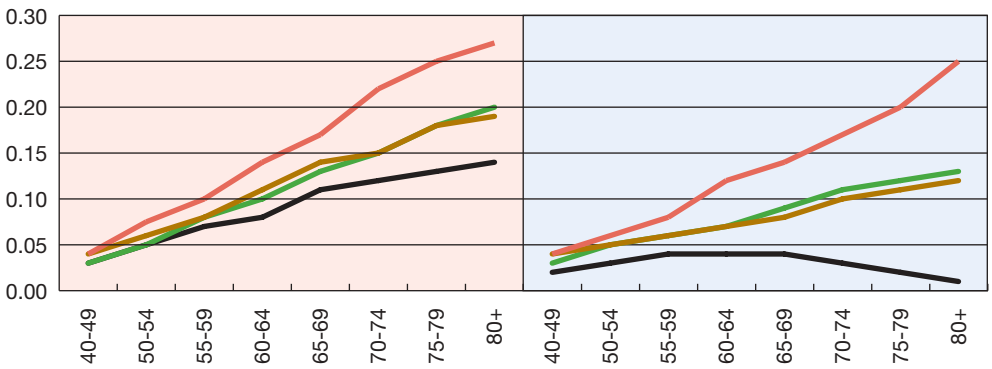
Figure 2-14: Prevalence of eye diseases by age and gender, adults over 40, US, 2000. *Source: Prevent Blindness in America (2002)*

Female **Male**

Myopia (1.00 diopters or worse)

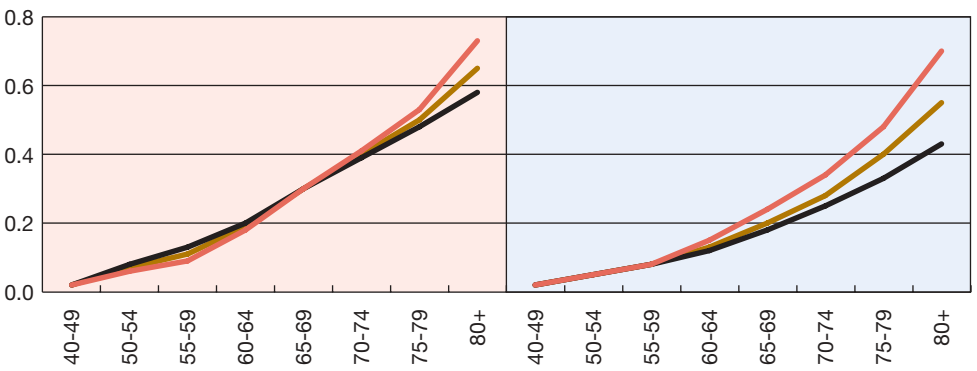


Hyperopia (3.00 diopters or worse)



Cataract

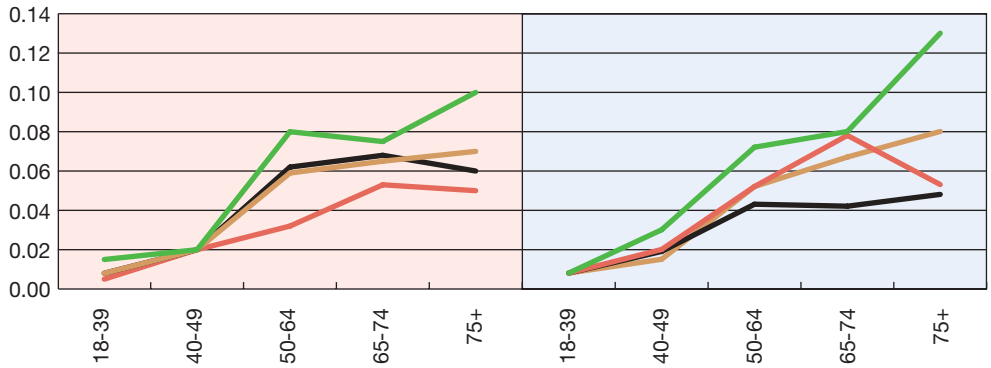
Note: Other and Hispanic are similar



International comparisons

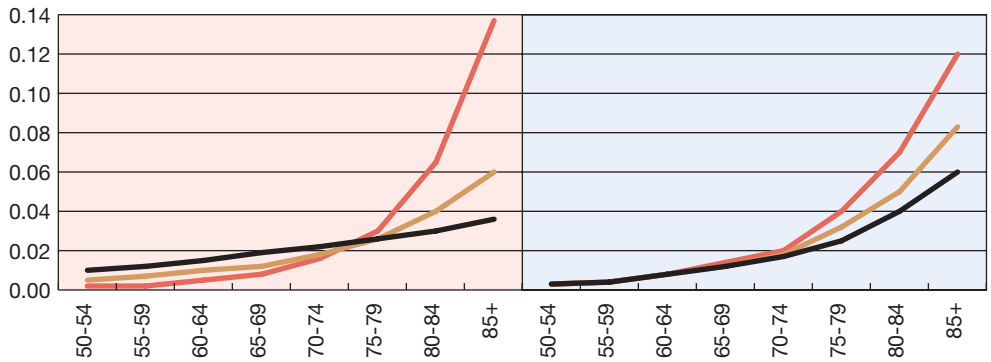
Female **Male**

Diabetic Retinopathy

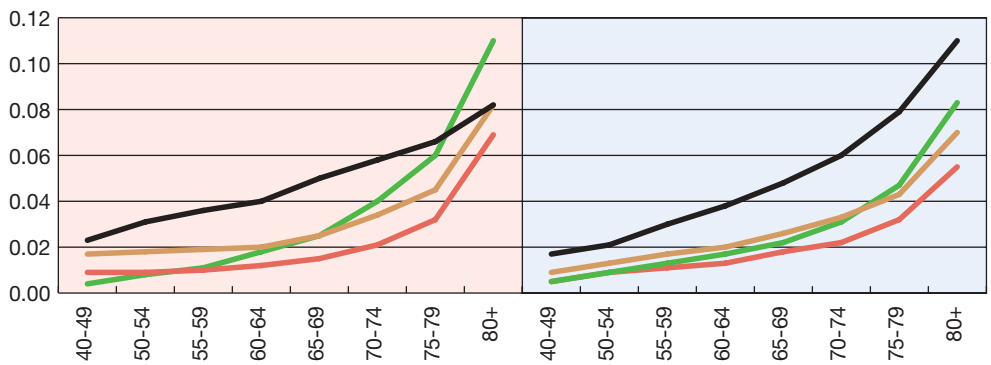


Macular Degeneration

Note: Other and Hispanic are similar



Definite primary angle open Glaucoma



Costs

The United States spent US$23.1bn directly on eye care problems in 1999, 1.93% of total health spending (Smithen et al, 2004), slightly less than the 3.2% of health spending estimated for Australia. Approximately an equivalent amount is incurred in indirect costs associated with delivering eye care to those with problems (Garnett, 1999). Prevent Blindness America (2002) estimate that blindness and visual impairment cost the Federal government more than US$4 billion per year in benefits and lost taxable income alone. In total, direct and indirect financial costs equate to just under 0.5% of US GDP, which compares to our Australian estimate of 0.6% of GDP.

Table 2-11 below summarises expenditure on ocular disease by category for 1999 as estimated by Smithen et al (2004). The total expenditure includes medical and surgical services ($US12.6bn); glasses, contacts, and associated vision examinations (US$8.4bn); and laser-assisted *in situ* keratomileusis (LASIK, US$2.1bn). In 1999 glaucoma accounted for $1.8 billion of total ophthalmic spending. In 2000 it accounted for the third most common ophthalmic claim.

Table 2-11: Total expenses on ocular disease and related conditions, US, 1999

Category	Expenditure (US$m)
Cataract	5,086.39
Glaucoma	1,822.17
Other eye disorders	5,679.12
Glasses/contacts	8,411.38
LASIK	2,071.00
Total	**23,070.06**

Note: Other eye disorder includes retinal detachments, retinal defects, vascular occlusions, retinopathy, blindness and vision defects.
Source: Smithen et al (2004)

According to a study conducted by Ellwein and Urato (cited in Smithen et al, 2004) the proportion of Medicare patients receiving eye care increased from 41.1% in 1991 to 48.1% by 1998. This study also notes that the average charge for eye care per Medicare beneficiary declined 25% from $235 to $176 and *"much of the decrease in costs can be attributed to the decline in cataract-related charges which decreased despite an increase in the percent of beneficiaries with cataract-related expense"*. This is consistent with our findings of reduced cost per person for cataract, albeit by a smaller percentage amount (7%) and over a different period (93-94 to 2004).

International comparisons

Smithen et al (2004) highlight that expenditure on eye disease for the population 65 years and older was $5.5 billion in 1991 (4.7% of total Medicare spending for people over 65) rising nominally to $6 billion in 1999 but falling to only 2.8% of total Medicare spending for those 65+.

Other studies provide different estimates.

- A study undertaken by Alcon (2002) estimated that the total annual direct costs of AMD in the US was US$9.96bn. This equates to 0.1% of GDP in 2002.
- Prevent Blindness (2002) estimated that US$15bn per annum is spent on eye-wear in the US, which supports an optical industry worth more than US$30bn.

The costs for treating AMD are likely to rise disproportionally as new treatments develop.

2.5.2 United Kingdom

In the UK population[8] aged 65 and over, around 4.3 million people (or 52%) have impaired vision (The Royal College of Ophthalmologists of London, 2002). Impaired vision in the UK is defined as a visual acuity of less than 6/12 in either one or both eyes. Of those with impaired vision, the more prevalent conditions are:

- cataract - accounting for 55% of cases
- refractive error - accounting for 17% of cases
- age-related macular degeneration (11%), plus
- another 7% of cases with both cataract and macular degeneration.

Table 2-12 shows the prevalence of these conditions as a proportion of the total population (England and Wales) aged over 65[9]. Note that it is the prevalence of eye disease that has resulted in a visual impairment worse than 6/12. There are obviously others whose sight is better than 6/12 who may still have an eye disease.

[8] Work published by the Royal College of Ophthalmologists of London in this instance, refers to the population of England and Wales.

[9] Note that there is a difficulty in comparing the UK prevalence rates to the US rates described earlier. The US data relates to those aged 40 and over, compared to the UK data on those aged 65 and over. Also, the US prevalence rate describes all cases of visual impairment. Those for the UK relate to the prevalence of eye disease causing a visual impairment of less than 6/12 in either one or both eyes.

Table 2-12: Prevalence of eye disease causing visual impairment, UK*, adults 65+

	Total
Refractive Error	8.9%
Cataract	28.9%
Diabetic eye disease	0.5%
Macular degeneration	8.4%
Definite primary open angle glaucoma**	3.0-6.9%

** England and Wales. ** These figures relate to definite cases vs suspected cases in those over 60 years.*
Source: The Royal College of Ophthalmologists of London (2002)

In August 2003, the Guide Dogs for the Blind Association published a report on The Costs of Blindness in the UK (Ethical Strategies Ltd, 2003). Costs were calculated on two fronts:

- for those individuals registered as blind or partially sighted in England; and then
- allowing for under-representation on the 'Register'.

Registration on the UK Register of Blind and Partially Sighted is voluntary, but needed in order to receive some government aid. However, many social services do not require registration in order to benefit from their services. As such, the register is considered to under-report the number of blind and visually impaired. The Royal College of Ophthalmologists suggests the degree of under-reporting may be as high as 64% for blind and 77% for partially-sighted people (the Royal College of Ophthalmologists of London, 2002). The Costs of Blindness study allows for a tripling of the number registered.

The annual non-treatment costs[10] for those individuals registered as either blind or partially sighted in England is around UK£2.3bn, which equates to 0.2% of GDP and UK£7,561 per person. Allowing for under-reporting, the annual non-treatment cost could be as high as UK£7bn, equating to 0.7% of GDP (see Table 2-13).

[10] Non-treatment costs include a disability living allowance, attendance allowance, carers allowance, vision rehabilitation services, income support, productivity losses (using a human capital approach), community care, home care and residential care.

International comparisons

Table 2-13: Annual non-treatment costs for the blind and partially sighted, England, UK£, 2002

	Children	Working Age	Elderly	Total
Registered blind & partially sighted				
Annual cost (UK£ million)	9	1,098	1,210	2,317
% GDP	0.0	0.1	0.1	0.2
Annual cost per patient	1,123	19,841	4,980	7,561
All blind & partially sighted (inc unregistered)				
Annual cost (UK£ million)	27	3,294	3,631	6,952
% GDP	0.0	0.3	0.3	0.7
Annual cost per patient	1,123	19,841	4,980	7,561

Note: GDP calculations based on a 20002 GDP value for the UK of UK£1,043,301 million. Source: Ethical Strategies Ltd (2003)

The report also detailed some costing analysis for glaucoma and cataract (as shown in Table 2-14). The total annual cost of glaucoma in the working and elderly age groups is UK£27bn, representing 2.6% of GDP in 2002. The total annual cost of cataract in the elderly population is around UK£11bn, representing 1.1% of GDP.

Non-treatment costs make up the bulk of expenses associated with these two diseases, accounting for 92% and 83% of total annual costs per patient for glaucoma and cataract respectively.

Table 2-14: Annual costs of glaucoma and cataract, UK£, 2002

	Non-treatment costs	Treatment costs	Total costs
Glaucoma (in the working age & elderly)			
Annual cost (UK£ million)*	24,733	2,252	26,953
% GDP**	2.4	0.2	2.6
Annual cost per patient	11,161	1,016	12,178
Cataract (in the elderly population)			
Annual cost (UK£ million)*	9,251	1,927	11,178
% GDP**	0.9	0.2	1.1
Annual cost per patient	3,301	688	3,989

** Based on a total number of individuals with glaucoma of 2.2 million and with cataract of 2.8 million. ** GDP calculations based on a 2002 GDP value for the UK of UK£1,043,301 million. Source: Ethical Strategies Ltd, 2003.*

These two reports highlight the difficulties of obtaining reliable data for the UK on the prevalence of eye disease. This should necessarily throw caution to using data relating to total costs, although on a per patient basis, they may be a more reliable indication of costs incurred.

3. Indirect costs and burdens

In addition to the direct health system expenditure estimated in the previous chapter, there are two types of indirect costs of visual impairment estimated in this chapter:

- **Financial costs, which include earnings (and taxation) forfeited due to the disabling nature of eye disease and its premature mortality rates, as well as the costs of carers, and of aids and modifications; and**

- **Non-financial costs from loss of healthy life - the pain, premature death and loss of life quality that result from visual impairment; these are more difficult to measure, but can be analysed in terms of the years of healthy life lost, both quantitatively and qualitatively, known as the 'burden of disease'.**

3.1 Loss of earnings

Visual impairment has significant socio-economic costs.

3.1.1 Lower employment rates

As noted in Section 1.6.4, the VIP data found that for people with vision disorders aged 40 to 65, only 34.5% were employed compared to 68.8% in the general population, while for those with vision disorders aged over 65, only 2.0% were employed compared to 5.8% without visual impairment in April 2004 (AusStats, 2004). We need to standardise this data for the likely suspects:

Age: The distribution of those in the 40-65 age group is skewed towards older people. If those employed had the same age distribution as those with visual impairment, the total employment rate would be 62.0% and the difference 27.5%, although there would be no impact on the unemployment rate (it would remain at 3.8%). It was not possible (and not so important) to age-standardise for those over 65 due to data constraints.

Gender: Because employment rates for females are lower than for males, excess women in the sample would skew the employment rate. However, the VIP data show there are a slightly higher proportion of males with visual impairment in the 40-69 and 90+ age groups, although there are a higher proportion of females aged 70-89 years. This was not a significant factor so no adjustments were made.

Socioeconomic status and comorbidities: There were insufficient data to standardise for these factors, although they may have an influence. In particular, the impacts of other comorbidities have not been accounted for, and may be important. Hence we refer to these costs as 'associated with people with visual impairment' rather than 'due to visual impairment'.

If those with visual impairment were employed in the workforce at the same rate as average Australians of the same age, there would be, *ceteris paribus*, an extra 45,443 people in the workforce in 2004 - 28,603 aged 40-65 and 16,840 aged over 65. With average weekly earnings (AWE) of $752.30 per week, these workers would generate an additional $1,781m in extra income in Australia.

This figure may be a conservative estimate of the true loss as many people may reduce their workload or have greater days absent, rather than stop work completely, as a result of the health impacts of visual impairment, or they may not be promoted as rapidly as their sighted peers. Income losses of carers of people with visual impairment who reduce or give up work in order to care for the person with the illness are identified in Section 3.2.3.

3.1.2 Potential tax revenue forgone

There are two sources of lost tax revenue that result from the lower earnings above - the potential income tax foregone, and the potential indirect tax foregone (sales tax, GST). The latter is lost because, as income falls, so does consumption of goods and services. While the exact extent of the latter effect should best be calculated in the context of a general equilibrium model of the economy, it is possible to calculate a ballpark estimate as summarised in Table 3-1 below.

The table shows the tax losses estimated as $493m in 2004, comprising $379m (77%) of personal income tax and $114m of indirect tax (23%).

Table 3-1: Potential earnings and tax revenue lost, Australians with visual impairment, 2004

Potential Earnings Lost	$1,781.1m
Average personal income tax rate#	21.2%
Potential personal income tax lost	$377.6m
Average indirect tax rate#	15.51%
Potential indirect tax lost	$140.5m
Total potential tax revenue lost	**$518.1m**

 # Source: AEM Model, Access Economics Pty Limited.

3.1.3 Mortality burden

In addition to income foregone due to those with visual impairment in the community being unable to work in 2004, there is also the income foregone of those who die prematurely. This section provides an estimate of this 'mortality burden' of premature deaths related to visual impairment, assuming that if those who died had lived and been fully sighted, they would have been employed at the same rate as the general population.

The calculation is made separately for those aged 40-65 and for those aged over 65, with numbers of deaths attributable to visual impairment based on the discussion in Section 1.6.2. In all, 18 deaths of people under 65 and 566 deaths of people over 65 are attributable. Those who would have been employed are estimated to be 11 and 37 respectively for each age bracket.

Using retirement age of 65 and average age at death of 57.2 for those with visual impairment aged under 65, average life expectancy at age 65 of 84.2 years and average age at death of 82.8 years for those with visual impairment aged over 65, and a discount rate of 1.55% (see *Methodology*), the net present value of the premature mortality burden is $5.3m. The net present value (NPV) of taxation revenue sacrificed for the mortality burden is $1.5m in 2004.

3.2 Other indirect financial costs

3.2.1 Carer costs

Provision of day-to-day care and support for people with visual impairment is often provided by family carers and friends. Society, and our public sector health and welfare budget, relies heavily on the support that carers provide.

Carers Australia estimates there are at least 2.3m Australians (one in every five households) providing care for family members or friends with a disability, chronic condition or who are frail aged. Nearly 20% (450,900) of these are 'primary' carers, of whom 70% are female. The 'invisible workforce' saves the economy around $16 billion annually and is the major provider of community care services, delivering 74% of all services to people needing care and support. The Home and Community Care (HACC) Program, worth over $1.1billion nationally, meets only 9% of this need. 78% of primary carers are of workforce age (15 to 64 years) yet 59% are not attached to the workforce. Over one-half of all full time carers reported incomes of less than $200 per week, while also experiencing the increased expenses of looking after another person. 40% of primary carers have been providing care for a decade or more, and 68% for more than 5 years. Care is mostly for a partner (43%), child (25%) or parent (21%), and most primary carers (54%) said that they provided care either because alternative care was unavailable or too costly, or because they consider they have no choice. Carers suffer from generally worse physical health, tiredness, stress, back/muscle problems, depression, anxiety and lack of respite.

Counselling, education, support and respite services are essential for carers, result in improved health outcomes for people with visual impairment, and reduce demand on clinical health services, especially hospitalisations and residential care. Costs for carers are calculated in Section 3.2.3 below.

3.2.2 Aids, equipment and home modifications

People who are visually impaired or blind 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 (CCTVs);
- 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, ramps.

There are a number of public programs for people with a disability and their families and carers to assist them to make home modifications and provide aids and equipment that will help them to remain living in their own home.

- The Home Maintenance and Modification Program (HMMP), funded by State and Commonwealth Governments under the HACC program, offers two levels of assistance. The lower level is the Home Modification and Maintenance Services program, which includes installation of grab rails, hand showers, taps and moveable ramps, as well as minor home maintenance and repairs. Major work over $5,000 is assisted through the Home Maintenance Scheme, with the cost up to 20% of the total cost of the job.
- The Program of Appliances for Disabled People (PADP) provides equipment and appliances to disabled people and some others, who are financially disadvantaged, including adjustable beds, hoists and mechanical lifters, shower chairs and bath seats.

Costs for carers are calculated in Section 3.2.3 below.

3.2.3 Calculation of other indirect financial costs

Frisch (2001, Table 1, p18) undertook detailed survey work of the costs of indirect items in Australia for people with disabilities, as shown in Table 3-2. This table is based on mean annualised costs from the DFaCS Survey of Disability Support Pensioners and originally reported in Walsh and Chappell (1999). The data show that annual costs for carers averaged $1,687.40 per annum in 1999 (items 1 plus 2), extrapolated to $1,909.14 by 2004 using an inflation rate of 2.5% per annum.

Table 3-2 permits two estimates for aids, equipment and modifications. The low estimate ($600.10 per annum) includes items 5, 8 and 9 - housing modifications, aids and appliances and special furniture. The high estimate ($938.39 per annum) also includes consumables (Item 6), although the inclusion of these is ambiguous as they may also potentially be covered to some extent under direct medical costs. To maintain a conservative approach, we exclude these consumables.

Table 3-2: Source data for costs of carers, aids and other indirect costs

	Cost item $ pa	1999	2004
1.	Care - inc. personal care, bathing, travel assistance	943.80	1,067.8
2.	Home tasks - inc house cleaning, gardening, house maintenance	743.60	841.3
3.	Travel - inc MV modifications, taxis, community transport	660.40	747.2
4.	Uncapped prescriptions	267.80	303.0
5.	Housing modifications - amortised	265.20	300.0
6.	Consumables - eg, dressings, ointments, batteries, incontinence pads	299.00	338.3
7.	Health practitioners	306.80	347.1
8.	Aids & appliances inc wheelchairs, special clothing, communic'n aids	174.20	197.1
9.	Furniture - amortised	91.00	103.0
Total		**3,751.80**	**4,244.82**
Sum 1, 2 (carers)		**1,687.40**	**1,909.14**
Sum 5, 8, 9 (aids and modifications) - low		**530.40**	**600.10**
Sum 5, 6, 8, 9 (aids and modifications) - high		**829.40**	**938.39**

Source: Frisch (2001) from DFaCS Survey of Disability Support Pensioners (Walsh and Chappell, 1999).

The Centre for Eye Research Australia is currently conducting a study of indirect costs that includes the costs of carers specifically for people with visual impairment. 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 four categories:

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

Pilot studies were conducted to test the format and content of the questionnaires and cost diaries, which were produced in large print, audio, Braille and electronic versions. 74 participants completed 12 months of diaries, with mean age 67.2 years and 55.4% female.

Circulation of diaries commenced in February 2003; by July 2003 six months of data were analysed and reported in Chou and Keeffe (2004). Results are summarised in Table 3-3, for the original year (of collection), 2003.

Other indirect financial costs

Table 3-3: CERA data on carers and aids, 2003, $PA

Cost category	Annual mean $
Medicines, product and equipment	455.64
Health and community services	387.00
Informal care and support	487.80
Lost production of helper	1,228.08
Informal care and support (inc. lost production of helper)	1,715.88
Other expenses	443.16
Total (excluding lost production of helper)	**1,773.56**
Total (including lost production of helper)	**3,489.42**

These numbers are different from the Frisch data, as expected, for a few reasons:

- the Frisch data were related to people with disabilities, whereas the CERA data relates to people with mild, moderate, severe and profound vision loss; and
- different items are included in the different surveys (eg, the Frisch data does not impute the value of the lost production of a carer); and
- the CERA data are for 2003.

We are interested in marrying the CERA and Frisch data to:

- estimate costs in 2004 (so the CERA data are increased by 2.5%);
- estimate average costs across the population of people with visual impairment (so the CERA data forms the basis for the calculations); and
- avoid double counting medical items (eg, over-the-counter medicines, health services delivered in the community) that are already included in direct costs - so these are netted out (on the basis of their proportion in the Frisch data, for the category 'Medicines, product and equipment').

As with the employment data, because there is insufficient data to control for other comorbidities (eg, people who have visual impairment and another chronic illness such as cardiovascular disease, diabetes or arthritis), we can not attribute the full cost as due to visual impairment, but rather note that these costs are experienced by people living with visual impairment. The total costs, applied to the population of 480,257 with visual impairment, are summarised in Table 3-4:

- $240m for the outlaid cost of carers (informal care and support) and $605m for the lost production of informal carers, totalling $845m together;
- $153m for aids and equipment; and
- $1.216bn in total in 2004.

The indirect costs of carers, aids and equipment for people with visual impairment are $1.2 billion.

Table 3-4: Indirect financial costs for people with visual impairment, 2004

Reconciliation	Annual mean cost ($pa)		
	Frisch (disabled only)	CERA (all)	Total ($m)
Carers	1,909.14	500.00	240.1
Lost productivity of carer		1,258.78	604.5
Aids and equipment minus medicines	570.57	317.85	152.6
Other (excl. health services)	1,150.19	454.24	218.2
Total (excluding lost production of carer)	**3,629.90**	**1,272.08**	**610.9**
Total (including lost production of carer)		**2,530.86**	**1,215.5**

3.2.4 Welfare and other transfer payments

In calculating total costs, it is important to distinguish between real costs and transfer payments:

- **Real costs** use up real resources, such as capital or labour, or reduce the economy's overall capacity to produce goods and services.
- **Transfer payments** involve payments from one economic agent to another, that do not use up real resources, for example, a disability support pension, or taxation revenue.

This important economic distinction is pivotal in avoiding double-counting. We have already identified taxation losses due to the lower employment of people with visual impairment as $493.3m in 2004 and a further $1.5m due to their premature death and hence the loss of future potential income streams.

Similarly, we can take the data on lost earnings of carers a little further and calculate the lost taxation revenue associated with their caring activities as $175.8m in 2004, using the same methodology as for the people with visual impairment themselves.

There may be some element of other transfer payments associated with visual impairment, including:

- **Carer Payment**, a means-tested government payment to people who provide full-time care to a person;
- **Carer Allowance** is a lower payment that is not means-tested;
- **Disability Support Pension (DSP)**, for people (aged 16-64) who have an illness, injury or disability and are unable to work (permanent blindness is one criterion for eligibility); and
- **Unemployment benefits**, for Australians of working age who are looking for work but unable to find it (means-tested).

Other indirect financial costs

We can make approximate estimates of these payments by assuming that:

- Unemployment benefits are paid to those with VI who are unemployed 'in excess' of those who would be on average in the population;
- DSP is paid to all those who are blind and aged between 40-65;
- Carer Allowance is paid to carers of those who are blind and aged 65 or more - this is very much an approximation since we do not have data on the mix between those who receive the Payment, the Allowance, their ages, or other access to other forms of care (eg residential care).

The estimates are summarised in Table 3-5, together with estimates of total tax transfers. Welfare payments are assumed to have deadweight costs associated with them of 5% to administer the system, while administration of the taxation system costs around 1.25% (derived from total amounts spent and revenue raised in 2000-01, relative to the Commonwealth department running costs). However, larger deadweight losses (DWLs) from taxation also arise from the distorting impact that taxes have on workers' work and consumption choices. It is estimated that this amounts to 27.5% of each extra tax dollar that is required to be collected (Lattimore, 1997 and used in Productivity Commission, 2003, p6.15-6.16, with rationale). Table 3-5 thus also shows the estimated real losses arising from these sources, noting:

- there are in fact net savings on unemployment benefits since the fewer people (relative to the average) over 65 with visual impairment who are unemployed outweigh the 'extras' under 65 with visual impairment who are unemployed;
- conservatively, the assumption is not made that welfare payments must be funded by further taxation that imposes additional 27.5% DWLs, since deficit funding or other alternatives might also possibly be exercised (and since this argument might be used in relation to the direct health funding also);
- total estimated welfare transfers are $155m, with $7.7m of real DWLs and total estimated tax revenue losses are $695.4m, with $190.4m of real DWLs;
- in total, real deadweight losses from transfer payments for people with visual impairment are estimated to be $207.7m in 2004.

Table 3-5: Transfer payments and associated deadweight losses, 2004

	$pa	People	Total $m	% DWL	Total $m
Welfare payments					
Carer payment	11,073.40				
Carer allowance	2,342.60	46,131	108.1		
Unemployment benefits (single, over 60 has been used as upper marker)	10,112.70	-198	-2.0		
Disability support pension	11,073.40	4,416	48.9		
Total welfare			**155.0**	**5.0**	**7.7**
Taxation revenues from....					
Lost earnings of people with VI			518.1		
Lifetime earnings of people who die 'due to' VI			1.5		
Lost earnings of people who care for people with VI				175.8	
Total tax revenue			**695.4**	**28.75**	**199.9**
Total, welfare and taxation					**207.7**

3.3 Burden of disease

The pain, suffering and premature death from conditions like visual impairment can be measured using the internationally developed 'Burden of Disease' methodology, which has earned recognition in Australia and overseas as a useful way of estimating the years of healthy life lost due to a condition. This method uses DALYs-or 'disability adjusted life years'-as the measuring stick. DALYs have two components:

- the years of life lost (YLL) due to premature death-the mortality burden; and
- the years of healthy life lost due to disability (YLD)-the morbidity burden.

DALYs, YLLs and YLDs provide indicators that are useful in measuring the impact of disease and exploring the effectiveness of health spending in terms of purchasing years of healthy life. The Australian Institute of Health and Welfare has provided some excellent analysis in this area. Mathers et al (1999) estimate the burden of disease in 1996 for a variety of disease and injury categories. Table 3-6 extrapolates their estimates for YLD for glaucoma, cataract, DR and age-related vision disorders to 2004 based on the growth in numbers of people with visual impairment over the period 1996-2004 (25%). There is no estimate for YLL here since Mathers et al (1999) base their work on an assumption that no-one dies prematurely from vision disorders. The estimate for DR is based on 2.9% of the YLD for diabetes mellitus, with the 'attributable fraction' being the (low) Australian proportion of people with DM with vision-threatening DR (0.1/0.75*0.9/4.1) from Section 1.2.

Table 3-6: Disability burden (YLD) from vision disorders, Australia, 2004

	Glaucoma	Cataract	Age-related vision disorders	Diabetic Retinopathy	Total
Males	**513**	**1,803**	**5,463**	**2,191**	**9,970**
0-14	-	4	-	101	105
15-34	-	5	-	108	113
35-54	-	41	-	687	729
55-74	161	724	1,311	908	3,103
75+	352	1,030	4,152	386	5,921
Females	**1,808**	**5,444**	**20,942**	**1,903**	**30,098**
0-14	-	3	-	111	113
15-34	-	4	-	165	168
35-54	174	340	903	513	1,930
55-74	176	1,120	1,965	685	3,945
75+	1,459	3,978	18,074	429	23,940
Total	**2,321**	**7,247**	**26,405**	**4,094**	**40,068**
0-14	-	6	-	212	218
15-34	-	9	-	273	282
35-54	174	381	903	1,200	2,659
55-74	336	1,844	3,276	1,593	7,048
75+	1,811	5,008	22,226	816	29,861

Source: Access Economics Pty Limited based on Mathers et al (1999).

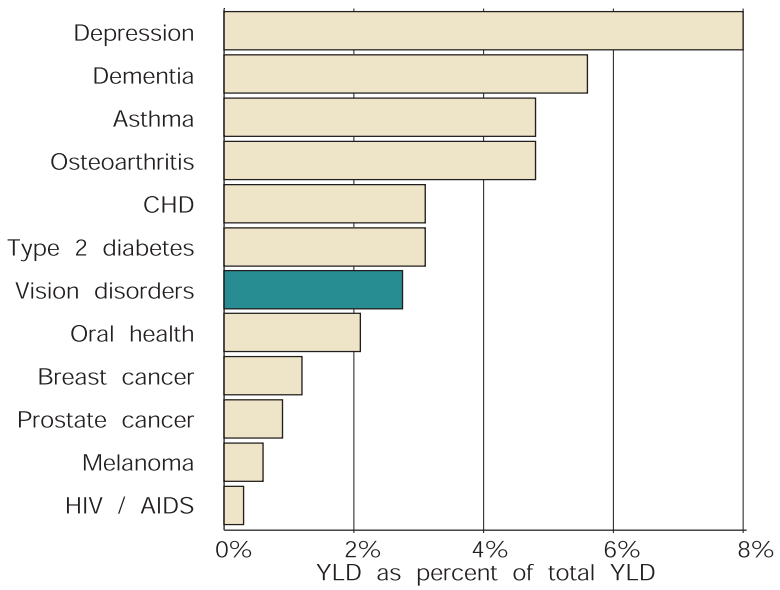
Vision disorders represent nearly 3% of the total disability burden of disease

In Australia in 2004, the disability burden attributable (YLD) to these visual disorders was estimated as 40,068 years. Females bore three quarters of the overall burden and about the same proportion was borne by people aged 75 and over.

Figure 3-1 compares the YLD burden of vision disorders with selected other conditions.

- Vision disorders represent 2.7% of the total YLD (disability) burden.
- This is more than the YLD burden associated with breast cancer (1.2%), prostate cancer (0.9%), melanoma (0.6%), or HIV/AIDS (0.2%).
- It is around half the YLD burden associated with dementia (5.6%), which has the second highest disability burden in Australia, after depression (8.0%).

Figure 3-1: Comparison of YLD burden - vision disorders and selected others



Note: Vision disorders includes glaucoma, cataract, age-related vision disorders and diabetic retinopathy. The latter is not included in YLD for Type 2 diabetes. Source: Access Economics Pty Limited based on Mathers et al (1999), Annex Table F, for the year 1996.

It is noteworthy that the disability weights for vision loss are 0.020 for mild cases, 0.170 for moderate cases and 0.430 for vision loss. The latter weight is similar to conditions such as schizophrenia, aortic aneurysm, skull fracture, moderate intellectual disability or the primary therapy stage of various cancers. The next section provides further comparison with other conditions.

Based on the number of deaths derived in Section 1.6.2, we have estimated the numbers of years of life lost (YLL) due to visual impairment, assuming that average life expectancy is 84.2 years and the discount rate is 3.3% (see Methodology). The results are summarised in Table 3-7, with the total estimate 1,195 YLLs. In total then, lost years of healthy life (YLL and YLD) in 2004 are 41,187 DALYs.

Table 3-7: Estimates of YLL due to visual impairment, 2004

	Deaths	Average age at death	Average life expectancy	Difference (years)	YLL
40-65	18	57.2	84.2	27.0	333
65+	566	82.8	84.2	1.4	785
Total	**584**				**1,119**

The cost of suffering and premature death due to visual impairment is $4.8 billion.

We might also take the step of converting DALYs to a financial equivalent, by assuming a value for a statistical life year (VLY). The process for attributing a VLY is detailed in the Methodology. The VLY we select, after consideration of the international literature, is $162,561. Estimation of the financial value of the suffering and premature death due to visual impairment in Australia is thus 41,187 * 162,561 = $6.7bn.

Sensitivity analysis to the assumptions in relation to the value of suffering and premature death are shown in Table 3-8.

- If the discount rate were reduced to 1.55% from 3.3% (effectively assuming no productivity gains), the VLY would be lower and thus so would the value of the DALYs lost - down to $5.1bn.
- If the years over the discounting period were reduced from 40 to 30, the VLY would be increased and thus so would the total cost - up to $7.8bn.
- If the VSL used was the average ($6.5m) rather than the low-point ($3.7m) of the range reviewed in the literature, the cost would be much higher - $11.8bn.

Table 3-8 Sensitivity analysis, cost of suffering and premature death, 2004

	Base Case	Scenario 1 Discount rate	Scenario 2 Years	Scenario 3 VSL
	3.3%, 40, $3.7m	1.55%	30	A$6.5m
VLY	$162,561	$122,907	$189,898	$285,579
Value of DALYs	$6,695.3	$5,062.1m	$7,821.3m	$11,762.1m

A final consideration is that the source studies from which the VSL is drawn implicitly include the individual's estimation of other personal costs - notably lost earnings (after tax) and out-of-pocket expenses. Thus the net cost of suffering and premature death from visual impairment should exclude these, to avoid double counting.

- From the $6.70bn we net out lost earnings after tax ($1.27bn - ie, $1.79bn minus $0.52bn) and payments to carers - but not carers lost earnings ($0.24bn) - and cost of aids and other out-of-pocket expenses ($0.37bn).
- The net cost of suffering and early death is then reduced from $6.70bn to $4.82bn.

4. Conclusions and strategies

This chapter summarises the cost estimates from the previous two chapters, and outlines strategies aimed at reducing the cost and burden of visual impairment in the future.

4.1 Summary of costs

Total direct and indirect financial costs in 2004 are over $5.0 billion.

Total real financial costs (direct and indirect) of visual impairment are over $5.0 billion in 2004 (over 0.6% of GDP).

- The real indirect financial costs of visual impairment are estimated as $3.2 billion, around 76% more than total direct health costs ($1.8 billion).
- In addition, there were $850 million of transfer payments - both lost revenue (tax foregone for people with visual impairment and their families and carers) and expenditure (carer and other welfare payments). These are not included in the real cost estimates or the totals.

Moreover, the net human cost of suffering and premature death, over and above the lost earnings and personal outlays of those with visual impairment, is estimated to be a further $4.8 billion in 2004.

- This is nearly as much again as the financial costs.
- The total costs of visual impairment (direct and indirect) including suffering are thus estimated to be $9.85 billion in 2004.

Excluding suffering, the $5.0bn of financial cost:

- represents $252 for every Australian, or $10,482 for every person over 40 with visual impairment in Australia in 2004.

Table 4-1 and Figure 4-1 provide further detail on the magnitude and composition of the costs, excluding the estimate for suffering and premature death.

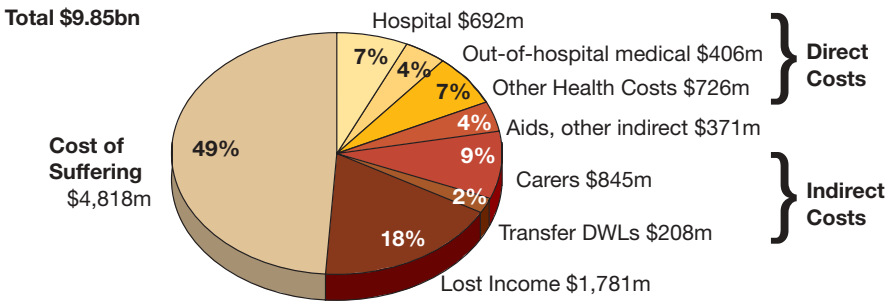
- The largest cost item is lost earnings for people with visual impairment ($1.78 billion) at around 35% of real financial costs.
- Carer costs ($845m or 17%) are second, hospitals third ($692m or 14%) and out-of hospital medical costs (largely specialists and GPs) are next ($406m or 8%).
- The table also shows the cost shares relative to the $9.8 billion total ie, including suffering.

Summary of costs

Table 4-1: Summary of costs, vision disorders, 2004

Cost element	Real cost $m	Transfer $m	Real as % subtotal	Real as % total
Direct health costs	**$1,824.4**		**36.2%**	**18.5%**
Hospitals	$692.0		13.7%	7.0%
Out-of-hospital medical	$406.4		8.1%	4.1%
Indirect financial costs				
Lost earnings (people with VI)	$1,781.1		35.4%	18.1%
Mortality burden	$5.3		0.1%	0.1%
Tax foregone (people with VI)		$519.6		
Value of carers	$844.7		16.8%	8.6%
Tax foregone (carers)		$175.8		
Aids & other indirect costs	$370.8		7.4%	3.8%
Welfare payments		$155.0		
Deadweight losses	$207.7		4.1%	2.1%
Total indirect financial	**$3,209.6**		**63.8%**	**32.6%**
Subtotal, financial costs	**$5,034.0**	**$850.4**	**100.0%**	**51.1%**
Per capita (population)	**$252**	**$42**		
% GDP	**0.61%**	**0.10%**		
Net suffering and premature death	**4,817.6**			**48.9%**
Total including suffering	**9,851.6**			**100.0%**

Figure 4-1: Composition of total costs, vision disorders, 2004



4.2 Cost effective interventions

Eye care has a range of proven, low risk, high success and cost effective interventions. Measured by cost utility and cost effectiveness analysis, which aim at integrating the value derived from an intervention with the associated costs of the intervention to arrive at dollars spent per Quality Adjusted Life Year gained - normally expressed as $/QALY (see Methodology regarding QALYs and DALYs). Like DALYs, QALYs measure not just increases in length of life but also improvements in quality of life.

There is a variety of opinion on where bounds for cost-effective interventions lie. The World Health Organization (2002) defines cost-effective and very cost-effective as:

- cost effective: one to three times GDP per capita to avert one lost DALY; for Australia, A$37,000 to A$112,000.
- very cost-effective: less than GDP per capita to avert one lost DALY; for Australia less than A$37,000.

Brown et al (2004) suggest that interventions costing less than US$50,000/QALY gained are cost effective whereas those costing more than US$100,000/QALY gained are not cost effective.

> *Cost-effectiveness analyses should be used to identify high, medium and low priority interventions to prevent or reduce risks, with highest priority given to those interventions that are cost-effective and affordable.... Population-based strategies aim to make healthy behaviour a social norm, thus lowering risk in the entire population. Small shifts in some risks in the population can translate into major public health benefits... Very substantial health gains can be made for relatively modest expenditures on interventions." World Health Organization (2002, p8,11-13)*

Table 1-1 from Brown et al (2004) lists some of the cost-utility values of various vitreoretinal interventions. It is important to emphasise that expensive treatments can be cost effective if they confer significant value to a person in terms of longevity and quality of life. On the other hand inexpensive treatments are not cost effective if they offer negligible value. For example, photodynamic therapy is not particularly cost effective, at around $91,924/QALY, as its associated costs are high. In contrast, vitreoretinal laser interventions for retinopathy of prematurity, diabetic retinopathy and exudative macular degeneration are very cost effective and range from US$781/QALY to US$17,041/QALY.

Screening for diabetic retinopathy by ophthalmologists every two years has a cost of US$49,760 per QALY (Vijan, 2000). This compares with costs of $15,000 for annual screening with a non-mydriatic camera and $37,000 for screening once a year by ophthalmologists in remote indigenous communities (Maberley, 2003).

Cost effective interventions

Vision 2020 estimates that cataract surgery in developing countries can cost as little as US$15-32 per DALY saved, and the provision of spectacles/lenses are also highly cost-effective. In the US, first eye cataract surgery cost US$2,020 per QALY and second eye cataract surgery was almost as cost effective at US$2,727 (Busbee, 2002; Busbee, 2003).

Table 4-2: Cost utility analyses Ophthalmologic interventions (results converted to year 2004 US dollars)

Intervention	$/QALY gained
Laser therapy for threshold retinopathy of prematurity	781
Cryotherapy for threshold retinopathy of prematurity	2,074
Vitrectomy for vitreous haemorrhage in patients with type 1 diabetes	2,085
Initial cataract surgery	2,141
Screening of and cryotherapy for, retinopathy of prematurity	3,232
Laser therapy for diabetic macular oedema	3,386
Screening and treating eye disease in patients with diabetes mellitus	3,816
Laser therapy for extrafoveal choroidal neovascularization with histoplasmosis	4,633
Laser therapy for subfoveal choroidal neovascularization associated with ARMD	6,259
Laser therapy for macular oedema associated with branch retinal vein occlusion	6,978
Laser therapy to prevent neovascular glaucoma with very ischemic central retinal vein occlusion	17,041
Annual screening for retinopathy (versus every 2 years) in high risk type 2 diabetes	44,251
Surgery for PVR, C3F8 (no previous vitrectomy)	77,012
Surgery for PVR, silicon oil (no previous vitrectomy)	85,670
Prophylactic oral gancyclovir treatment for cytomegalovirus retinitis	93,095
Photodynamic therapy for subfoveal choroidal neovascularization with ARMD	
- 20/40 initial vision	91,924
- 20/200 initial vision	184,423
Treatment (anterior chamber paracentesis + Carbogen therapy) for central retinal artery occlusion	4.13 million

Note: $/QALY gained, dollars expended per quality-adjusted life year gained; MD, age-related macular degeneration; PVR, proliferative vitreoretinopathy.
Source: Brown et al (2004).

Needless blindness and poor vision can be eliminated only if people worldwide have access to sight-saving medical and surgical techniques.

4.3.1 Vision 2020 The Right to Sight: The global initiative

Vision 2020 (WHO) is a global coalition of international agencies, led by the World Health Organization and the International Agency for the Prevention of Blindness, cooperating to eliminate avoidable blindness and vision loss by the year 2020.

In its first annual report, Vision 2020 Report on World Sight 2002, it was noted that:

- Needless blindness and poor vision can be eliminated only if people worldwide have access to sight-saving medical and surgical techniques.
- The treatments available for the prevention and cure of blindness are among the most successful and cost-effective of all health interventions.
- The latest estimate for the direct economic cost of the global burden of blindness is more than US$28 billion per year.
- The Vision 2020 Initiative is one where the solutions are known and the expertise and knowledge is well documented.
- To make the fight against avoidable blindness possible, governments, as part of the unique partnership in Vision 2020: the Right to Sight need to make a strong political commitment. There is an equally important role for the private sector and civil society.

4.3.2 Vision 2020 Australia

Vision 2020 Australia is a collaboration of a wide range of Australian organisations working in the areas of eye health, research, education, low vision, rehabilitation, peer support and community services. Vision 2020 Australia was launched in October 2000 to raise awareness and promote eye care as a significant health issue in Australia. Vision 2020 Australia has developed Strategies and Recommendations to achieve the “Right to Sight” in Australia by the year 2020. They include the need:

- to identify the issue of eye health and vision care as a priority area and for the Government to recognise this through inclusion on the national health agenda.
- to increase community awareness of the importance of eye health and vision care through specific initiatives including:
  - Programs to encourage routine vision testing at least every five years and every two years for high risk groups.
  - Promotion of regular use of sunglasses and protective eye wear to reduce eye injury, UV exposure and radiation eg, linked to SunSmart.
  - Promotion of non-smoking to prevent age-related macular degeneration and cataract eg, linked to QUIT.
  - Protection from eye injuries in rural areas and at home.
  - To coordinate and fund prevention, education, early intervention and rehabilitation to reduce the impact of vision loss.

- Screening for high risk groups, including those with diabetes, a family history of eye disease and Aboriginal and Torres Strait Islander people.
- Vision testing for older Australians as a part of extended aged care assessment by GPs and by Aged Care Assessment Teams.
- Improved access to services for specific disadvantaged groups, such as those from cultural and linguistically diverse backgrounds.
- Education of the public of the importance of prevention, early intervention, rehabilitation and education programs.
- Improved access and coverage to low cost spectacle services across Australia by altering eligibility and reducing waiting lists.
- Increased awareness of services, roles and responsibilities among service providers.
- Increased awareness and effective referral pathways to eye health and rehabilitation services.

Recommendations

Vision 2020 Australia (2001) recommends that the Commonwealth Government and Vision 2020 Australia form a Working Group to implement the following agenda.

- The Commonwealth and State/Territory Governments commit to work together with Vision 2020 Australia to eradicate preventable blindness and its impact through appropriate funding, early detection, prevention, rehabilitation, education and research.
- The Commonwealth Government include the issue of eye health and vision care on the national health agenda.
- The Commonwealth and State/Territory Governments in conjunction with Vision 2020 Australia and its partners develop strategies to ensure that every Australian has equitable access to eye health and rehabilitation services.
- The Commonwealth and State/Territory Governments in conjunction with Vision 2020 Australia and its partners develop general awareness strategies on:
  - the need for regular eye examinations;
  - the need for sunglasses and protective eye wear;
  - the linkage between smoking and eye disease; and
  - that vision loss is not a necessary consequence of ageing.
- The Commonwealth and State/Territory Governments, Vision 2020 Australia and other health professionals develop strategies to ensure that an optimum referral process exists to minimise vision loss and its impact on a person's independence.

4.4 Issues for the future

Much can be done to cost-effectively prevent blindness and visual impairment in Australia.

- Blindness and cancer are the two most feared health conditions that people want to prevent (Taylor, 2001).
- Australia has good tertiary and secondary eye care services. We also have some of the best data in the world, if not the best, on the distribution and impact of visual impairment.
- These data show the trebling of vision loss with each decade of life with substantial impacts on independent living and the quality of life, and the looming issues presented by demographic ageing.
- Projected prevalence, cost and burden of disease figures presented in this report confirm the need to develop and utilise treatments and technologies to improve the eyesight of the increasing number of people who would otherwise lose vision.
- Australia needs to take vision loss seriously. Blindness and vision loss have huge and broad-ranging impacts on our society.
- Much can be done because so much blindness and vision loss can be prevented or treated with cost-effective interventions.

Half of visual impairment is correctable and one quarter is preventable.

Higher priority must be given to service delivery for eye care and low vision support services.

- Well-constructed strategies (such as Vision 2020 Australia) and programs such as the Vision Initiative are available that can be implemented without delay.
- Implementation programs require evaluation and may require further health services research to document their cost-effectiveness or to fine-tune them.
- Other research is necessary to address the questions of blindness and vision loss that currently are unable to be comprehensively treated, particularly conditions such as glaucoma and macular degeneration. Substantially increased public sector research funding through NHMRC and other bodies is needed.
    - Access Economics Pty Limited (2003) outlines the exceptional returns to investment in health research and development (R&D) for cause, care and cure. Returns over the period 1960-1999 from Australian health R&D, realised through the value of improved longevity and healthspan, have averaged 2.4:1 for every dollar spent, ranging from 1:1 to 5:1. Research increasingly needs to be viewed as an investment in health outcomes for ourselves and our children.
- The distribution of and access to eye care services need to be improved, especially the delivery models available in rural and remote Australia. Given the major impact of visual impairment, the long waiting lists for cost-effective procedures like cataract surgery need to be addressed.
- There is a need for rehabilitation services for most people with vision loss, however less than a quarter of people with vision loss access these services. Rehabilitation services have the potential to maintain quality of life and thus reduce the disability burden of visual impairment.

Issues for the future

- Further research is needed to develop models of effective services that can provide for greater numbers of people with impaired vision. The increase in numbers is not only from the ageing of the population but more effective referral services.
- There is also a need to recognise that prevention is often much more cost-effective than treatment, and to promote education and awareness raising public health actions.

Expanded funding for research is recommended to address the questions of blindness and vision loss that currently are unable to be successfully prevented or treated.

Methodology

Prevalence, mortality, morbidity and socio-economic impacts

Data on age-specific prevalence rates by gender, mortality rates, morbidity, service utilisation and socio-economic impacts was derived from combined datasets from the Melbourne Visual Impairment Project (VIP) and the Blue Mountains Eye Study (BMES). These data were provided by the Centre for Eye Research Australia and applied to AusStats data on the Australian population by age and gender from the Australian Bureau of Statistics. Because the calculation of the number of deaths from visual impairment in 2004 is quite novel and complex, the methodology for this calculation is described in detail in the body of the text - Section 1.6.2.

The Melbourne Visual Impairment Project (VIP): The VIP was conducted by the (University of Melbourne Department of Ophthalmology) Centre for Eye Research Australia from 1991 to 1999 to establish the prevalence and cause of visual impairment in Victoria and to examine health care utilisation. It was a population-based, epidemiological survey of 5,147 people 40 years and older who lived in randomly selected sites, It examined 3,271 people in the Melbourne metropolitan area, 403 people in urban aged-care homes and 1,473 in rural Victoria. Over 86% of those selected participated fully. Its findings can be applied to the whole Australian population (Taylor, 2001). More detail on the methodology is provided from McCarty et al (2001) below.

Cluster random sampling was employed to identify nine pairs of census collector districts in the Melbourne statistical division from which to recruit eligible participants. Eligible adults were defined as people aged 40 years and older who had been resident in their homes for at least six months. A household census was conducted to identify the eligible residents, collect basic demographic information, and invite the eligible residents to attend the local examination centres. The standardised examinations lasted approximately 90 minutes and included presenting and best corrected visual acuity, reading vision, Humphrey visual fields, intraocular pressure, personal health and health related habits interview, clinical ophthalmic examination, and photography of the lens and fundus. The Wilmer lens grading scheme was used and cataract was defined as ≥4/16 cortical opacity, ≥nuclear standard 2.0, or ≥1 mm2 posterior subcapsular opacity. Glaucoma diagnosis was determined by a consensus of glaucoma experts after review of intraocular pressure, visual fields and optic discs. Age related maculopathy was graded from fundus photographs according to the international classification. The protocol was approved by the Human Research and Ethics Committee at the Royal Victorian Eye and Ear Hospital.

Five year follow up examinations commenced in 1997. In 1996, letters were mailed to each of the 3,271 people who participated in the urban areas at baseline. These letters contained information about some of the baseline results and alerted them to the fact that 5 year follow up examinations would commence in 1997. Before the commencement of the 5 year follow up examinations at each of the nine test sites, information sessions were held to inform the participants of the baseline results and

to tell them what to expect from the follow up examinations. Again, recruiters contacted each of the original participants to organise convenient appointment times for them, including nights and weekends where necessary. Information about contact people that was provided by the participants at baseline was used to locate people who had moved and to identify those people who had died in the intervening 5 years. If necessary, people were examined in their homes or nursing homes. Interpreters were provided if needed.

Confirmation and causes of death were obtained from the National Death Index, which is maintained by the Australian Institute for Health and Welfare in Canberra. After providing the National Death Index with a list of names and associated age and last known address for the participants that had died, researchers at the National Death Index provided a corresponding list of 'matched' deaths. They provide a list of causes of death, when known, for individuals who are matched by name, year of birth, and year of death. The matches are assigned a probability of being the same person from the list provided to them.

Interview data were entered directly into a Paradox computer package with consistency checks built in. All other data were entered twice and verified. Statistical analyses were conducted with SAS version 6.0. Pearson's _^{2} analyses were used to identify univariate predictors of participation and mortality for categorical variables and Mantel-Haenszel _^{2} analyses were used for ordinal variables. Multivariate logistic regression analyses were used to identify independent predictors of participation and 5 year mortality. Survival analyses were conducted with the Wilcoxian test for statistical significance of the survival curves. A p value of less than 0.05 was considered to be statistically significant.

At baseline, the VIP cohort was 54% female and ranged in age from 40 to 98 years, with a mean of 59 years. Of the original 3,271 participants, 231 (7.1%) were reported to have died in the intervening 5 years. Of the remaining 3,040 participants eligible to return for follow up examinations, 2,594 (85% of eligible) did participate, 51 (2%) had moved interstate or overseas, 83 (3%) could not be traced and 312 (10%) refused to participate. The time between baseline and follow-up examinations ranged between 4 and 7 years (mean 4.5 years, SD 0.64, median 4 years). The mean age of the participants at follow up was 62.5 years (10.9, 44-101) and 1,421 (55%) were female.

The Blue Mountains Eye Study (BMES): The BMES is a population-based survey of non-institutionalised residents aged 49 years and older from two postcode urban areas in the Blue Mountains west of Sydney, Australia. It was conducted by the Department of Ophthalmology at the University of Sydney (Centre for Vision Research of the Westmead Millennium Institute). Detailed methods of the survey have been published elsewhere (Chia et al, 2004). A door-to-door household census of these two postcode areas was conducted to identify 4,433 eligible residents and 3,654 (82.4%) attended the eye examination. A further 135 nursing home residents within the region were also examined, as were another 1,174 persons who later moved into

Methodology

the age group and area (total 4,963). All participants completed a questionnaire, administered by trained interviewers, covering demographic characteristics, medications, visual function and medical history at the clinic visit. Other questions, particularly regarding current diet, were completed prior to the visit by participants.

The detailed eye examination included presenting and best-corrected visual acuity, a screening visual field test, applanation tonometry, and stereo optic disc photography and typically lasted around 120 minutes. Best-corrected visual acuity was measured for those with vision less than 6/6, using a standardised subjective refraction, using the Early Treatment Diabetic Retinopathy Study (ETDRS) method. The diagnosis of age-related macular degeneration (AMD) was made using masked grading of 30-degree stereo macular photographs, using the Wisconsin method and the International Classification. Graders were trained in Wisconsin. Late AMD was diagnosed when either neovascular AMD or geographic atrophy was present. Age-related cataract was diagnosed from slit-lamp and retro-illumination photographs of the lens of each eye, graded using the Wisconsin classification of nuclear, cortical and posterior subcapsular (PSC) opacities. Significant cataract was considered as nuclear grades ≥3, ≥25% cortical opacity or ≥5% PSC opacity. Open-angle glaucoma was diagnosed from the presence of matching typical glaucomatous optic disc and visual field (Humphrey 30-2 perimetry, following a screening visual field) changes. The diagnosis did not take into account the intraocular pressure level or previous treatment for glaucoma, and excluded persons with angle closure or other secondary causes (except pseudoexfoliation), detected at gonioscopy. Diabetic retinopathy was diagnosed by the presence of typical retinopathy lesions in participants with diagnosed diabetes or with elevated fasting blood glucose levels (≥7.0 mmol/L).

At baseline, the BMES community and home cohort was 55% female and ranged in age from 49 to 98 years, with a mean of 68 years. Five-year follow-up examinations commenced in 1997, and concluded in 1999, after the re-examination of 75.1% of survivors. Ten-year follow-up examinations commenced in late 2002 and were due to conclude in the second half of 2004. Progressive mortality data on this cohort have been generated from Australian National Death Index reports, supplied by the Australian Institute of Health & Welfare. Dual data entry of questionnaire and study workbooks was performed, with development of linked Microsoft Access databases, analysed using SAS.

For this combined analysis all participants were classified according to the vision in their better eye. Low vision was defined as presenting visual acuity in the better eye <6/12 for refractive error; otherwise, it was defined as best corrected visual acuity in the better eye <6/12. Refractive error was the attributed cause of low vision when people with presenting visual acuity <6/12 had a best corrected visual acuity ≥6/12. A similar definition was applied to blindness, where presenting visual acuity is <6/60. For cases other than refractive error, the major disease in the better eye was assigned as the cause of vision loss. If there was more than one condition present, the most clinically significant and irreversible disease was assigned as the major cause of vision loss.

Direct health system costs

Direct health system costs can be estimated in one of two ways-the 'bottom up' approach, calculated by adding actual (or imputed) costs for a representative cohort of patients, or the 'top-down' approach, which attributes total health expenditures to disease based on available information on the mix of diseases treated and the costs of treatment. While the former is sometimes more accurate in giving up-to-the-minute estimates for specific diseases, there can be problems in obtaining representative samples and representative cost patterns, and the advantage of the latter approach is that there will be consistency of coverage and estimates across diseases, which can be more helpful for policy makers.

In this study, the top-down approach is adopted, based on the methodology developed by the Australian Institute of Health and Welfare (AIHW), in collaboration with the National Centre for Health Program Evaluation (NCHPE) for the Disease Costs and Impact Study (DCIS). This major study measures health services utilisation and expenditure for specific diseases and disease groups in Australia, in accordance with the Ninth Revision of the International Classification of Disease (ICD-9) published by the World Health Organisation (WHO). The DCIS methodology has been gradually refined to estimate direct costs of hospitals, GP and specialist medical services, allied professionals, pharmaceuticals, nursing homes, research and other costs (such as administration), primarily from hospital morbidity data, case mix data and the National Health Survey (NHS), as well as other sources. DCIS methodology is detailed in Mathers et al (1998), while results are provided in Mathers and Penm (1999).

The AIHW provided updated costings in 2004 for the year 2000-01 (AIHW, 2004). In this paper, detailed 2000-01 data specially requested from the AIHW were used as a base for projections to 2004. Two factors contribute to the extrapolation:

- health cost inflation, which measured 3.2% in 2000-01 and is assumed to measure 2.8% (the annual average rate for 1997-98 to 2001-02) till 2004, as detailed in Table M-1; and
- projected growth of the population with visual impairment, based on AusStats data and age-specific prevalence rates derived from the epidemiological data outlined above.

Methodology

Table M-1: Health cost inflation, % per annum, Australia, 1991-92 to 2001-02

Period	Health inflation	General inflation
2000-01 to 2001-02	3.2	2.5
Average annual rates of inflation		
1992-93 to 1997-98	2.5	1.5
1997-98 to 2001-02	2.8	2.3
1991-92 to 2001-02	2.5	1.8

Source: AIHW (2003) Health Expenditure, Australia, 2001-2002, Cat No HWE 24, Health and Welfare Expenditure Series No 17, September.

Direct health cost projections to 2020 are calculated on a similar basis, using ABS Series II projections by age group for the demographic data. Health cost inflation based on three different scenarios is detail in Section 2.3, which also cautions the use of these projections due to the substantial associated risk - even small technological breakthroughs in cost-effective interventions, for example, could alter the composition and aggregate of cost components significantly given the size of the populations impacted and the medium to long term timeframe. Policy initiatives targeting modifiable risk factors could also have substantial implications over the decade.

Indirect costs

The World Health Organization and cost of illness studies in the past have typically classed indirect costs as all those costs that are not direct health system costs, the approach adopted here. More recently, the importance of making the economic distinction between real and transfer costs has become recognised, as defined in Section 3.2.4. Transfer costs are important when adopting a whole-of-government approach to policy formulation and budgeting. Measurement of indirect costs remains a matter of some debate and controversy.

Lost earnings and production ('human capital'): This focuses on the loss of production or earnings associated with illness and premature death. The higher end of such estimates includes absenteeism costs plus the discounted stream of lifetime earnings lost. The lower end might include only the 'friction' period until the worker can be replaced, which would be highly dependent on labour market conditions and un(der)employment levels.

The approach adopted in this paper is limited by data constraints - there is no robust data on absenteeism, for example. Since employment rates were found in the socio-economic analysis to be lower for people with visual impairment relative to the average Australian (including age-standardised), the lost production for 2004 can be calculated on the basis of the difference. It is assumed that, in the absence of visual impairment, these people would obtain employment at the same rate as the average Australian, and earn the same average weekly earnings, based on the most recent

ABS *Average Weekly Earnings*, AWE, Cat No 6302.0 released 20 May 2004 for the February quarter - all employees total earnings of $752.30 per week, including full and part time earnings across all occupations and regions (ABS, 2004). An implicit assumption is that the number of such people would not be of sufficient magnitude to substantially influence the overall clearing of the labour market. The more difficult issue, discussed in Section 3.1.1, is that the data has not controlled for other comorbidities that may contribute to lower overall employment rates.

Mortality burden: The mortality burden makes similar assumptions to those above if, in the absence of the illness, those people with visual impairment did not die in 2004 but rather were well and participated in employment similarly to average Australians, and for the same expected duration - 48 people in all (see Section 3.1.3).

- The average age at death of 40-64 year olds with visual impairment who die (57.2 years) and of those over 65 who die (82.8 years) is derived from the demographic profile of deaths derived from the mortality rates and utilising the attributable fraction approach discussed in Section 1.6.2.
- Expected retirement age is assumed to be 65 for those under 65 and average life expectancy (at age 65) for those 65 and over is supplied by the ABS as 82.4 years for males and 86.0 years for females - 84.2 years on average.
- The discount rate for the net present value (NPV) of the future income stream - 1.55% - is based on three components, in accord with the literature.
  - The 5-year nominal government bond rate reflects *positive time preference* (5.8%) - ie, the reality that individuals value income (and good health) in the present more than in the future.
  - The nominal bond rate must be deflated by expected average *inflation* as per the mandated target of 2-3% pursued by the Reserve Bank of Australia (2.5%).
  - For wage income streams this needs to be reduced also by expected *productivity growth* over the next two decades, assumed to be in line with the Commonwealth's *Intergenerational Report* from 2010 (1.75%).
- Then NPV = _Y/(1+r)^i where Y=$39,195, r=1.55% and i=1,2...7.8 for those 40-64 and i=1,1.4 for those aged 65 and over.

Potential tax revenue foregone: People with visual impairment or their families and carers who work less or retire early will not only forego income, but will also pay less personal income tax. The income tax foregone is a product of the average personal income tax rate and the foregone income. With visual impairment and lower income, there will be less consumption of goods and services, estimated up to the level of the disability pension. Without visual impairment, it is conservatively assumed that consumption would comprise 90% of income (the savings rate may well be lower than this). The indirect tax foregone is a product of the foregone consumption and the average indirect tax rate. Average tax rates for 2004 as shown in Table 3-1 are derived from the AE macroeconomic model, incorporating changes from 1 July to the upper marginal tax rates. Tax revenue sacrificed is included as a transfer payment (not a real economic cost).

Family carer costs: Placing a value on the cost of unpaid family care is one of the most difficult aspects of disease costing. It is nonetheless a hugely important indirect cost, and becoming more so as, in Australia, we increasingly accommodate people with disabilities and frail aged people in the community.

There are three usual methods of estimating the cost or value of families and carers:

- an *opportunity cost* approach - the value of the work (earnings) and/or leisure they sacrifice (possibly also including the health and emotional wellbeing that they sacrifice);
- the *replacement cost* approach - what the government would have to pay if a family carer were absent;
- what family carers themselves feel they should be paid (eg, as in the O'Shea 2000 Irish study, which interestingly provided an estimate of only £2 to £4 per hour).

However, there is no robust data from any of these approaches for visual impairment in Australia. Hence the data from the relatively small bottom-up studies of care and other indirect costs from Frisch (2001) and from Chou and Keeffe (2004) are adopted to derive an estimate for total carer costs as detailed in Section 3.2.

Aids and other indirect costs: These were also based on the Frisch (2001) and Chou and Keeffe (2004) data, as detailed in Section 3.2.

Social welfare payments: The Disability Support Pension, Newstart and the various carer payments are transfers from taxpayers to those receiving them, not real economic costs. The weighted average payment per annum in Table 3-5 is derived from the Centrelink website <www.centrelink.gov.au> for each of the various payments, with weights split equally between singles and couples. The methodology for the calculations for the payments and the deadweight costs of all transfers is transparently described in Section 3.2.4.

Burden of disease - valuing life and health

People's suffering and premature death from the disabling and distressing symptoms of disease goes well beyond the financial costs. To those experiencing visual impairment and blindness, less tangible costs such as mental anguish, loss of leisure and physical pain and disability are often as or more important than productivity losses.

Since Schelling's (1968) discussion of the economics of life saving, the economic literature has properly focused on *willingness to pay* (willingness to accept) measures of mortality and morbidity risk. Using 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 etc), economists have developed estimates of the *value of a 'statistical' life (VSL)*.

The willingness to pay approach estimates the value of life in terms of the amounts that individuals are prepared to pay to reduce risks to their lives. It uses stated or revealed preferences to ascertain the value people place on reducing risk to life and reflects the value of intangible elements such as quality of life, health and leisure. While it overcomes the theoretical difficulties of the human capital approach, it involves more empirical difficulties in measurement (BTE, 2000, pp20-21).

Viscusi and Aldy (2002) summarise the extensive literature in this field, most of which has used 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 possibility of death or morbidity by x%. They find the VSL ranges between US$4m and US$9m with a median of US$7m (in year 2000 US dollars), similar but marginally higher than the VSL derived from US product and housing markets, and also marginally higher than non-US studies, although all in the same order of magnitude. They also review a parallel literature on the implicit value of the risk of non-fatal injuries.

A particular life may be regarded as priceless, yet relatively low implicit values may be assigned to life because of the distinction between identified and anonymous (or 'statistical') lives. When a 'value of life' estimate is derived, it is not any particular person's life that is valued, but that of an unknown or statistical individual (Bureau of Transport and Regional Economics, 2002, p19).

Weaknesses in this approach, as with human capital, 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.

Viscusi and Aldy (2002) include some Australian studies in their meta-analysis, notably Kniesner and Leeth (1991) of the Australian Bureau of Statistics (ABS) with VSL of US2000 $4.2m and Miller, Mulvey and Norris (1997) of the National Occupational Health and Safety Commission (NOHSC) with quite a high VSL of US2000$11.3m-19.1m (Viscusi and Aldy, 2002, Table 4, pp92-93). Since there are relatively few Australian studies, there is also the issue of converting foreign (US) data to Australian dollars using either exchange rates or purchasing power parity and choosing a period.

Access Economics Pty Limited (2003) presents outcomes of studies from Yale University (Nordhaus, 1999) - where VSL is estimated as $US2.66m; University of Chicago (Murphy and Topel, 1999) - US$5m; Cutler and Richardson (1998) - who model a common range from US$3m to US$7m, noting a literature range of $US0.6m to $US13.5m per fatality prevented (1998 US dollars). These eminent researchers apply discount rates of 0% and 3% (favouring 3%) to the common range to derive an equivalent of $US 75,000 to $US 150,000 for a year of life gained.

Methodology

DALYs and QALYs

In an attempt to overcome some of the issues in relation to placing a dollar value on a human life, in the last decade an alternative approach to valuing human life has been derived. The approach is non-financial, where pain, suffering and premature mortality are measured in terms of Disability Adjusted Life Years (DALYs), with 0 representing a year of perfect health and 1 representing death (the converse of a QALY or "quality-adjusted life year" where 1 represents perfect health). This approach was developed by the World Health Organization (WHO), the World Bank and Harvard University and provides 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).

The DALY approach has been adopted and applied in Australia by the Australian Institute for Health and Welfare (AIHW) with a separate comprehensive application in Victoria. Mathers et al (1999) from the AIHW estimate the burden of disease and injury in 1996, including separate identification of premature mortality (YLL) and morbidity (YLD) components. In any year, the disability weight of a disease (for example, 0.43 for vision loss) reflects a relative health state. In this example, 0.43 would represent losing 43% of a year of healthy life because of the vision loss.

Mathers et al (1999) estimate the burden of disease for diseases of the eye and adnexa in 1996 in Annex Tables F, G and H (YLD only). This was extrapolated to 2004 on the basis of projected growth in the prevalence of visual impairment over the period. The adjustment for diabetic retinopathy and the methodology for calculating the YLLs is described in Section 3.3.

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 nations have subsequently adopted variations in weighting systems. For example, in some countries DALYs are discounted for older people although in Australia the minority approach is adopted - valuing a DALY equally for people of all ages.

The main problem with the DALY approach is that it is not financial and is thus not directly comparable with most other cost measures. In public policy making, therefore, there is always the temptation to re-apply a financial measure conversion to ascertain the cost of an injury or fatality or the value of a preventive health intervention. Such financial conversions tend to utilise "willingness to pay" or risk-based labour market studies described above.

The Department of Health and Ageing (based on work by Applied Economics) has adopted a conservative approach to this issue, placing the value of a human life year at around A$60,000 per annum, which is lower than most international lower bounds on the estimate.

"In order to convert DALYs into economic benefits, a dollar value per DALY is required. In this study, we follow the standard approach in the economics literature and derive the value of a healthy year from the value of life. For example, if the estimated value of life is A$2 million, the average loss of healthy life is 40 years, and the discount rate is 5 per cent per annum, the value of a healthy year would be $118,000.11 Tolley, Kenkel and Fabian (1994) review the literature on valuing life and life years and conclude that a range of US$70,000 to US$175,000 per life year is reasonable. In a major study of the value of health of the US population, Cutler and Richardson (1997) adopt an average value of US$100,000 in 1990 dollars for a healthy year.

Although there is an extensive international literature on the value of life (Viscusi, 1993), there is little Australian research on this subject. As the Bureau of Transport Economics (BTE) (in BTE, 2000) notes, international research using willingness to pay values usually places the value of life at somewhere between A$1.8 and A$4.3 million. On the other hand, values of life that reflect the present value of output lost (the human capital approach) are usually under $1 million.

The BTE (2000) adopts estimates of $1 million to $1.4 million per fatality, reflecting a 7 per cent and 4 per cent discount rate respectively. The higher figure of $1.4 million is made up of loss of workforce productivity of $540,000, loss of household productivity of $500,000 and loss of quality of life of $319,000. This is an unusual approach that combines human capital and willingness to pay concepts and adds household output to workforce output.

For this study, a value of $1 million and an equivalent value of $60,000 for a healthy year are assumed.[12] In other words, the cost of a DALY is $60,000. This represents a conservative valuation of the estimated willingness to pay values for human life that are used most often in similar studies.[13]" (DHA, 2003, pp11-12)."

[11] In round numbers, $2,000,000 = $118,000/1.05 + $118,000/(1.05)2 + ... + $118,000/(1.05).40 [AE comment: The actual value should be $116,556, not $118,000 even in round numbers.]
[12] The equivalent value of $60,000 assumes, in broad terms, 40 years of lost life and a discount rate of 5 per cent.
[13] In addition to the cited references in the text, see for example Murphy and Topel's study (1999) on the economic value of medical research. [AE comment. Identical reference to our Murphy and Topel (1999).]

As the citation concludes, the estimate of $60,000 per DALY is quite low. The Viscusi (1993) meta-analysis referred to reviewed 24 studies with values of a human life ranging between $US 0.5m and $US 16m, all in pre-1993 US dollars. Even the lowest of these converted to 2003 Australian dollars at current exchange rates, exceeds the estimate adopted ($1m) by nearly 25%. The BTE study tends to disregard the literature at the higher end and also adopts a range (A$1-$1.4m) below the lower bound of the international range that it identifies (A$1.8-$4.3m).

The rationale for adopting these very low estimates is not provided explicitly. Certainly it is in the interests of fiscal restraint to present as low an estimate as possible.

In contrast, the majority of the literature as detailed above appears to support a higher estimate for VSL, as presented in Table M-2, which Access Economics Pty Limited believes is important to consider in disease costing analysis. The US dollar values of the lower bound, midrange and upper bound are shown at left. The 'average' estimate is the average of the range excluding the high NOHSC outlier.

Equal weightings are used for each study as the:

- Viscusi and Aldy meta-analysis summarises 60 recent studies;
- ABS study is Australian; and
- Yale and Harvard studies are based on the conclusions of eminent researchers in the field after conducting literature analysis.

Where there is no low or high US dollar estimate for a study, the midrange estimate is used to calculate the average. The midrange estimates are converted to Australian dollars at purchasing power parity (as this is less volatile than exchange rates) of USD=0.7281AUD for 2003 as estimated by the OECD (2004 not yet available).

Access Economics Pty Limited concludes the VSL range in Australia lies between $3.7m and $9.6m[14], with a mid-range estimate of $6.5m. These estimates have conservatively not been inflated to 2004 prices, given the uncertainty levels.

[14] Calculated from the non-indexed studies themselves. Converting the AE average estimates from USD to AUD at PPP would provide slightly higher estimates - $3.9m and $10.2m, with the same midrange estimate

Table M-2: International estimates of VSL, various years

		US$m		A$m
	Lower	Midrange	Upper	0.7281
Viscusi & Aldy meta-analysis 2002	4	7	9	9.6
Australian: ABS 1991		4.2		5.8
NOHSC 1997	11.3		19.1	
Yale (Nordhaus) 1999		2.66		3.7
Harvard (Cutler & Richardson) 1998	0.6	5	13.7	6.9
'Average'*	2.9	4.7	7.4	6.5

Average of range excluding high NOHSC outlier, using midrange if no data; conservatively not inflated. A$m conversions are at the OECD 2003 PPP rate.

To calculate the VLY, we conservatively use:

- the lower bound estimate of $3.7m;
- a discount rate of 3.3% (5.8%-2.5%) - ie we need to exclude productivity gains for suffering and premature death;
  - The US Panel on Cost -Effectiveness in Health and Medicine recommends an annual discount rate of 3% for both costs and QALYs (Brown et al, 2004).
- a time horizon of 40 years to death, based on the original source studies and as per DHA (2003).

This provides the VLY estimate of $162,561. The sensitivity of results for the VLY value (and hence the costs of suffering and premature death) to changes in these assumptions is provided in Section 3.3.

References

Access Economics Pty Limited (2003) *Exceptional returns: the value of investing in health R&D in Australia*, Prepared for the Australian Society for Medical Research, September.

Alcon (2002) *Annual Direct Cost of Illness of Age-Related Macular Degeneration in the US: Early Estimates of Societal Burden*, internal summary document.

AREDS Report No. 8 (2001) "A randomised, placebo-controlled clinical trial of high-dose supplementation with Vitamins C and E, beta carotene, and zinc for age-related macular degeneration and vision loss" *Arch Ophthal* 119:1417-1436.

AusDiab (2001) "Diabesity and associated disorders in Australia, 2000: the Accelerating Epidemic" *Australian Diabetes, Obesity and Lifestyle Report*, International Diabetes Institute, Melbourne.

AusStats (2004) Online statistics by subscription from the Australian Bureau of Statistics <www.abs.gov.au>.

Australian Bureau of Statistics (2004) *Labour Force, Australia*, Cat. No. 6302.0, February.

Australian Bureau of Statistics (2003) *Causes of Death, Australia*, Cat. No. 3303.0, December and previous issues for 2002, 2001, 2000.

Australian Bureau of Statistics (2002a) *National Health Survey 2001: Summary of Results*, ABS Cat. No. 4364.0, 25 October.

Australian Bureau of Statistics (2002b) *Deaths, Australia 2001*, ABS Cat. No. 3302.0, 10 December.

Australian Institute of Health and Welfare (2004) *Health system expenditure on disease and injury in Australia, 2000-01*, AIHW Cat No. HWE 26 Canberra: AIHW (Health and Welfare Expenditure Series no. 19).

Australian Institute of Health and Welfare (2003) *Health Expenditure, Australia, 2001-2002*, Cat No HWE 24, Health and Welfare Expenditure Series No 17, September.

Australian Institute of Health and Welfare (2002) Diabetes: Australian Facts 2002, downloadable from <www.aihw.gov.au/publications/cvd/daf02/daf02-c01.pdf>.

Brown MM, Brown GC and Sharma S (2004) "Value-based medicine and vitreoretinal diseases" Curr Opin Opthalmol 15:167-172.

Bureau of Transport Economics (2000) *Road Crash Costs in Australia*, Bureau of Transport Economics, Report 102, Canberra.

References

Bureau of Transport and Regional Economics (2002) *Rail Accident Costs in Australia*, Report 108, Commonwealth of Australia, Canberra.

Busbee BG, Brown MM, Brown GC, Sharma S (2003) "Cost-Utility Analysis of Cataract Surgery in the Second Eye" *Ophthalmology* 110:2310-2317.

Busbee BG, Brown MM, Brown GC, Sharma S (2002) "Incremental Cost-Effectiveness of Initial Cataract Surgery" *Ophthalmology* 109:606-613.

Chia EM, Wang JJ, Rochtchina E, Smith W, Cumming RR, Mitchell P (2004) "Impact of Bilateral Visual Impairment on Health-Related Quality of Life: the Blue Mountains Eye Study" *Invest Ophthalmol Vis Sci* 45:71-76.

Chou S-L and Keeffe JE (2004) "Vision Related Personal Costs for People with Impaired Vision in Australia" presented at *The Association for Research in Vision and Ophthalmology (ARVO) Conference*, 25 - 29 April 2004, Fort Lauderdale, USA (Conference Proceedings).

Congdon N, West S, Friedman DS, Kempen JH, Vingerling JR, Klein BE, O'Colmain BJ, Wu SY, Taylor HR, Wang JJ (2004) "Prevalence of Cataract and Pseudophakia / Aphakia among Adults in the United States" *Arch Ophthalmol* 122:487-494.

Coogan MJ (2004) "Vision loss from eye disease will increase as Americans age" Press Release, National Eye Institute, 12 April.

Costello P and Minchin N (2003) Budget Paper No. 2: Budget Measures 2002-03, Comonwealth of Australia, 14 May, available on <www.budget.gov.au/2002-03/bp2/html/03_BP2Expense_3.html>.

Cutler DM and Richardson E (1998) The Value of Health: 1970-1990, JCPR Working Paper 28, prepared for the AEA session on "What we get for health care spending" downloadable from <www.jcpr.org/wpfiles/value.pdf>.

Cutler DM and Richardson E (1997) "Measuring the health of the US population" *Brookings Paper on Economic Activity, Microeconomics*, Brookings Institute, Washington DC.

Department of Health and Ageing (2003) *Returns on investment in public health: An epidemiological and economic analysis*, Report to the Department of Health and Ageing by Applied Economics.

Ethical Strategies Limited (2003) The Costs of Blindness - An Analysis of the Costs of Visual Impairment and Blindness in the United Kingdom, Report prepared for The Guide Dogs for the Blind Association, downloaded 13 August 2003 from <www.guidedogs.org.uk/news/index.html>.

References

Friedman DS, Munoz B, Kempen JH, Congdon N, O'Colmain BJ, Tomany SC, McCarty CA, DeJong PTVM, Nemesure B, Mitchell P (2004) "The Prevalence of Age-related Macular Degeneration in the United States" *Arch Ophthalmol* 122:564-572.

Frisch J (2001) *Towards a Disability Allowance: Offsetting the Costs of Disability - An Analysis*, Prepared for the Physical Disability Council of Australia, June.

Garnett, C (1999) "Age-Related Eye Disease Doesn't Have to Steal Your Sight", from Word on Health, National Eye Institute, downloaded 7 August 2003 from <www.nih.gov/news/WordonHealth/jan99/story01.htm>.

Ivers RQ, Cumming RG, Mitchell P, Attebo K (1998) "Visual impairment and falls in older adults: The Blue Mountains Eye Study" *J Am Geriatr Soc* 46:58-64.

Keeffe JE, Weih LM, McCarty CA, Taylor HR (2002) "Utilisation of eye care services by urban and rural Australians" *Br J Ophthalmol* 86:24-27.

Kempen JH, Mitchell P, Lee KE, Tielsch JM, Broman AT, Taylor HR, Ikram MK, Congdon NG, O'Colmain BJ, Friedman DS (2004) "The Prevalence of Refractive Errors Among Adults in the United States, Western Europe and Australia" *Arch Ophthalmol* 122:495-505.

Klein BEK, Klein R, Lee KE, Cruikshanks KJ (1998) "Performance-based and self-assessed measures of visual function as related to history of falls, hip fractures and measured gait time" The Beaver Dam Eye Study, *Ophthalmol* 105:160-164.

Klein R, Klein BEK, Moss SE (1995) "Age-related eye disease and survival" The Beaver Dam Eye Study, *Arch Ophthalmol* 113:333-339.

Kniesner TJ and Leeth JD (1991) "Compensating wage differentials for fatal injury risk in Australia, Japan and the United States" *Journal of Risk and Uncertainty* 4:75-90.

Lattimore R (1997) *Research and Development Fiscal Incentives in Australia: Impacts and Policy Lessons*, Paper Presented to the OECD Conference on Policy Evaluation in Innovation, Paris, 26 27 June, 81:574-577.

Livingston PM, McCarty CA, Taylor HR (1997) "Visual impairment and socio-economic factors" *Br J Ophthalmol* 81:574-577.

Livingston PM, McCarty CA, Taylor HR (1998) "Knowledge, attitudes and self-care practices associated with age-related eye disease in Australia" *Br J Ophth* 82:780-785.

Maberley D, Walker H, Koushik A, Cruess A. Screening for diabetic retinopathy in James Bay, Ontario: a cost effectiveness analysis. *Canadian Med Assoc J* 2001;168:160-4.

References

Mathers C, Vos T and Stevenson C (1999) *The burden of disease and injury in Australia*, AIHW Cat No PHE-17, Australian Institute of Health and Welfare, Canberra.

Mathers C and Penm, R (1999) *Health system costs of injury, poisoning and musculo-skeletal disorders in Australia 1993-94*, AIHW Cat No HWE-12, Australian Institute of Health and Welfare, Canberra.

Mathers C, Stevenson C, Carter R and Penm R (1998) *Disease Costing methodology used in the Disease Costs and Impact Study 1993-94*, AIHW Cat No HWE-7, Australian Institute of Health and Welfare, Canberra.

McCarty CA, Mukesh BN, Taylor HR (2001) "Vision Impairment predicts 5-year mortality" *Br J Ophthalmol* 85:322-326.

McCarty CA, Lloyd-Smith CW, Lee SE, Stanislavsky YL, Livingston PM, Taylor HR (1998) "Use of eye care services by people with diabetes: The Melbourne Visual Impairment Project" *Br J Ophthalmol* 82:410-414.

Miller P, Mulvey C and Norris K (1997) "Compensating differentials for risk of death in Australia" *Economic Record* 73(223), 363-372.

Murphy KM and Topel R (1999) *The Economic Value of Medical Research*, University of Chicago Business School.

Murray C, Lopez A, Mathers C, & Stein C (2001) *The Global Burden of Disease 2000 Project: aims, methods & data sources*, Discussion Policy Paper No. 36, WHO, November.

Murray C and Lopez A (1996) *The Global Burden of Disease: a comprehensive assessment of mortality & disability from diseases, injuries & risk factors in 1990 & projected to 2020*, Volume 1, Global Burden of Disease & Injury Series, Harvard: Harvard School of Public Health.

National Eye Institute (2000a) Facts About Diabetic Eye Disease, NIE June, downloaded 7 August 2003 from <www.nei.nih.gov/ndmsite/facts.htm>.

National Eye Institute (2000b) Macular Degeneration National Institutes of Health, available on <www.eyesearch.com/macular.degeneration.htm>.

National Eye Institute (1998a) Cataract National Institutes of Health Publication No. 96-201, available on <www.eyesearch.com/cataract.htm>.

National Eye Institute (1998b) Glaucoma National Institutes of Health Publication No. 96-651, available on <www.eyesearch.com/glaucoma.htm>.

References

NHMRC (1997) "Management of diabetic retinopathy" *Clinical Practice Guidelines*, National Health and Medical Research Council, Commonweath of Australia Publication No. 2142.

Nordhaus W (1999) The Health of Nations: The Contribution of Improved Health to Living Standards, research papers presented at a conference sponsored by Lasker/Funding First, December, Department of Economics, Yale University, from <www.laskerfoundation.org/reports/pdf/healthofnations.pdf> 2 April 2003.

Prevent Blindness America (2002) Vision Problems in the U.S. - Prevalence of Adult Vision Impairment and Age-Related Eye Disease in America, downloaded 7 August 2003 from <www.nei.nih.gov/eyedata/pdf/VPUS.pdf>.

Productivity Commision (2003) "Evaluation of the Pharmaceutical Industry Investment Program" *Research Report*, AusInfo, Canberra.

Rovner BW, Ganguli M (1998) "Depression and disability associated with impaired vision: the MoVies Project" *J Am Geriatr Soc* 46:617-19.

Schelling (1968) "The life you save may be your own" in SB Chase (ed) *Problems in public expenditure and analysis*, Brookings Institution, Washington DC, p127-162.

Scot IU, Schein OD, Feuer WJ, Folstein MF, Bandeen-Roche K (2001) "Emotional distress in patients with retinal disease" *Am J Ophthalmol* 131:584-58.

Smith W, Mitchell P and Seeder SR (1996) "Smoking and age-related maculopathy" *Arch. Opthalmol*. 114:1518-1523.

Smith W, Assink J, Klein R et al (2001) "Risk factors for age-related macular degeneration: pooled findings from three continents" *Opthalmol* 108:697-704.

Smithen LM, Brown GC and Brown MM (2004) "Dollars and sight: the economics of ophthalmology" *Curr Opin Ophthalmol* 15:173-180.

Tapp RJ, Shaw JE, Harper CA, de Courten MP, Balkau B, McCarty DJ, Taylor HR, Welborn TA and Zimmet PZ (2003) "The Prevalence of and Factors Associated With Diabetic Retinopathy in the Australian Population" *Diabetes Care* 26:1731-1737, on behalf of the AusDiab Study Group.

Taylor HR (2003) "Eye Care for the Future: The Weisenfeld Lecture" *Invest Opthalmol* Vis Sci 44:1413-1418.

Taylor HR (2001) *Eye Care for the Community*, Centre for Eye Research Australia.

References

Taylor HR, McCarty CA, Nanjan MB (2000) "Vision impairment predicts five-year mortality" *Tr Am Ophthal Soc* 98:91-96.

The Royal College of Ophthalmologists of London (2002) A National Strategy for Ophthalmology 2002, downloaded 7 August 2003 from <www.rcophth.acc.uk/research_strategy02_epidemiology.html>.

Tolley GS, Kenkel DS, Fabian RG, eds (1994) Valuing Health for Policy: An Economic Approach, University of Chicago Press, Chicago.

Valbuena M, Bandeen-Roche K, Rubin GS, Munoz B, West SK (1999) "Self-reported assessment of visual function in a population-based study: the SEE project (Salisbury Eye Evaluation)" *Invest Opthalmol Vis Sci* 40:280-288.

VanNewkirk MR, Weih L, McCarty CA, Stanislavsky YL, Keeffe JE, Taylor HR (2000) "Visual impairment and eye diseases in elderly institutionalized Australians" *Ophthalmol* 107:2203-2208.

Vijan S, Hofer TP, Hayward RA. Cost-utility analysis of screening intervals for diabetic retinopathy in patients with Type 2 diabetes mellitus. *JAMA* 2000;283:889-896.

Viscusi WK (1993) "The value of risks to life and health" *Journal of Economic Literature*, 13:1912-46.

Viscusi and Aldy (2002) "The value of a statistical life: a critical review of market estimates throughout the world" Discussion Paper No. 392, Harvard Law School, Cambridge MA, November, downloadable from <www.law.harvard.edu/programs/olin_center/>.

Vision 2020 Australia (2001) "The Vision Initiative: A Public Health Program" Vision Initiative Development Steering Committee (VIDSC).

Walsh J and Chappell P (1999) *Cost of Disability Survey Stages 2 and 3 - Demonstration of Relationship: Severity of Disability v Cost*, Department of Family and Community Services, AGPS, Canberra.

Wang JJ, Mitchell P, Simpson JM, Cumming RG and Smith W (2001a) "Visual Impairment, Age-related Cataract and Mortality" *Arch Ophthalmol* 119:1186-1190.

Wang JJ, Mitchell P, Smith W et al (2001b) "Incidence of nursing home placement in a defined community" *Medical Journal of Australia* 174:271-275.

References

Wang JJ, Mitchell P, Smith W, Leeder SR (1999) "Factors associated with use of community support services in an older Australian population" *Aust NZ J Pub Health* 23:147-153.

Weih LM, McCarty CA, Taylor HR (2000) "Functional implications of vision impairment" *Clin Exp Ophthalmol* 28:153-155.

Wensor MD, McCarty CA, Stanislavsky YL, Livingston PM, Taylor HR (1998) "The prevalence of glaucoma in the Melbourne Visual Impairment Project" *Opthalmol* 105:733-739.

World Health Organization (2002) *The World Health Report 2002: Reducing Risks, Promoting Healthy Life*, WHO, Switzerland.

Table A 1 - Cataract
direct health costs 1993-94 ($) by age, gender and type

Age	Hospitals inpatients					Medical services				Pharmaceutical					
	Public	Private	Repatriation	Total	Nursing homes	GPs	Specialists	Total	OHPs	Prescription	Over the counter	Outpatients	Other	Research	Total costs
Male															
0-4	35,561	6,936	8,224	50,721	0	14,967	0	14,967	0	0	405	4,440	3,181	1,991	75,704
5-14	49,090	23,709	0	72,799	0	0	0	0	0	0	0	0	3,283	2,055	78,137
15-24	81,057	140,560	0												
221,617	0	0													
0	0	0	0	0	0	9,996	6,255	237,868							
25-34	225,145	269,711	11,257	506,113	0	25,642	55,340	80,982	0	0	8,714	85,419	30,726	19,227	731,182
35-44	392,598	829,142	4,901	1,226,641	0	25,076	159,305	184,380	0	0	6,834	88,467	67,941	42,515	1,616,778
45-54	1,088,914	2,534,627	15,631	3,639,172	69,512	28,842	199,719	228,561	0	0	9,264	312,211	192,084	120,201	4,571,005
55-64	3,075,499	6,928,214	55,082	10,058,795	171,322	116,583	1,544,390	1,660,974	0	0	47,906	194,222	547,252	342,456	13,022,928
65-74	8,027,571	18,764,410	1,811,658	28,603,639	2,258,750	209,644	3,107,099	3,316,743	72,804	0	76,130	961,374	1,591,680	996,033	37,877,154
75+	10,503,691	24,133,562	2,167,751	36,805,004	10,096,984	386,555	3,956,171	4,342,726	0	29,120	136,056	599,449	2,345,807	1,467,947	55,823,092
Total	23,479,126	53,630,871	4,074,504	81,184,501	12,596,569	807,309	9,022,024	9,829,333	72,804	29,120	285,308	2,245,582	4,791,949	2,998,681	114,033,847
Female															
0-4	24,217	20,834	0	45,051	0	0	0	0	0	0	311	0	2,046	1,280	48,688
5-14	21,598	43,057	0	64,655	0	0	0	0	0	0	0	0	2,916	1,825	69,396
15-24	43,691	106,634	0	150,325	264,602	0	0	0	0	0	0	0	18,715	11,711	445,353
25-34	94,444	223,573	0	318,017	0	11,722	0	11,722	0	27,957	6,497	3,526	16,585	10,379	394,683
35-44	298,307	561,818	20,532	880,657	0	12,114	0	12,114	0	26,836	6,001	7,858	42,103	26,347	1,001,915
45-54	826,535	2,372,501	10,622	3,209,658	280,663	2,989	87,187	90,176	0	0	7,519	74,536	165,194	103,374	3,931,120
55-64	2,970,611	6,988,220	57,520	10,016,351	1,147,077	97,814	725,158	822,971	0	0	51,800	118,340	548,303	343,114	13,047,958
65-74	10,696,214	26,964,530	561,763	38,222,507	4,365,941	433,224	3,323,661	3,756,885	426,763	28,549	122,429	1,675,664	2,191,977	1,371,684	52,162,398
75+	19,850,928	50,555,243	1,214,003	71,620,174	67,936,456	822,695	7,672,101	8,494,796	0	55,384	145,554	1,027,528	6,733,057	4,213,377	160,226,326
Total	34,826,545	87,836,410	1,864,440	124,527,395	73,994,739	1,380,557	11,808,107	13,188,664	426,763	138,726	340,111	2,907,451	9,720,897	6,083,091	231,327,837
Person															
0-4	59,778	27,770	8,224	95,772	0	14,967	0	14,967	0	0	716	4,440	5,227	3,271	124,393
5-14	70,688	66,766	0	137,454	0	0	0	0	0	0	0	0	6,200	3,880	147,533
15-24	124,748	247,194	0	371,942	264,602	0	0	0	0	0	0	0	28,710	17,966	683,221
25-34	319,589	493,284	11,257	824,130	0	37,364	55,340	92,704	0	27,957	15,210	88,945	47,311	29,606	1,125,864
35-44	690,905	1,390,960	25,433	2,107,298	0	37,190	159,305	196,495	0	26,836	12,835	96,325	110,043	68,862	2,618,693
45-54	1,915,449	4,907,128	26,253	6,848,830	350,176	31,831	286,905	318,736	0	0	16,783	386,747	357,278	223,575	8,502,125
55-64	6,046,110	13,916,434	112,602	20,075,146	1,318,400	214,397	2,269,548	2,483,945	0	0	99,706	312,562	1,095,555	685,571	26,070,886
65-74	18,723,785	45,728,940	2,373,421	66,826,146	6,624,691	642,867	6,430,761	7,073,628	499,567	28,549	198,559	2,637,038	3,783,657	2,367,717	90,039,551
75+	30,354,619	74,688,805	3,381,754	108,425,178	78,033,439	1,209,250	11,628,272	12,837,522	0	84,504	281,611	1,626,976	9,078,865	5,681,324	216,049,419
3,013	0	0	3,013	0	0	0	0	0	0	0	0	0	0	3,013	
Total	58,308,684	141,467,281	5,938,944	205,714,909	86,591,308	2,187,866	20,830,131	23,017,997	499,567	167,846	625,420	5,153,033	14,512,846	9,081,772	345,364,697

Table A 2 - Glaucoma
direct health costs 1993-94 ($) by age, gender and type

Age	Hospitals inpatients				Medical services				Pharmaceutical					
	Public	Private	Repatriation	Total	Nursing homes	GPs	Specialists	Total	OHPs	Prescription	Over the counter	Outpatients	Other	Research	Total costs
Male															
0-4	35,285	8,504	0	43,789	0	0	0	0	0	0	0	0	1,975	1,236	47,000
5-14	26,071	12,281	0	38,352	0	0	0	0	0	0	0	0	1,730	1,082	41,164
15-24	25,756	45,226	0	70,982	0	13,100	97,465	110,565	0	0	2,022	37,701	9,980	6,245	237,496
25-34	73,479	66,731	5,845	146,055	0	12,429	13,835	26,264	0	28,549	2,178	21,355	10,121	6,334	240,856
35-44	183,834	203,111	0	386,945	0	6,336	0	6,336	0	0	741	9,595	18,205	11,392	433,214
45-54	274,928	395,666	27,432	698,026	0	67,851	310,615	378,465	0	80,610	17,836	601,119	80,106	50,129	1,906,291
55-64	581,157	717,723	15,257	1,314,137	85,661	114,879	77,398	192,277	0	195,649	9,886	40,080	82,886	51,868	1,972,444
65-74	913,681	1,341,440	250,332	2,505,453	521,250	310,332	1,225,214	1,535,546	0	516,545	48,080	607,159	258,625	161,841	6,154,500
75+	927,123	1,092,961	374,554	2,394,638	174,086	306,722	34,579	341,301	282,039	513,298	14,040	61,858	170,548	106,725	4,058,533
Total	3,041,314	3,883,643	673,420	7,598,377	780,997	831,648	1,759,107	2,590,755	282,039	1,334,649	94,783	1,378,867	634,177	396,852	15,091,497
Female															
0-4	14,336	5,504	0	19,840	0	0	0	0	0	0	0	0	895	560	21,295
5-14	19,738	16,606	0	36,344	0	0	0	0	0	0	0	0	1,639	1,026	39,009
15-24	15,851	20,388	0	36,239	0	0	0	0	0	0	5,163	0	1,867	1,169	44,438
25-34	29,139	55,605	0	84,744	0	11,124	83,071	94,195	0	0	1,624	12,930	8,727	5,461	207,682
35-44	97,738	134,892	0	232,630	0	18,967	35,934	54,902	0	0	651	16,551	13,745	8,601	327,079
45-54	153,501	432,850	0	586,351	0	41,890	20,939	62,829	0	26,836	14,476	124,656	36,766	23,007	874,921
55-64	403,797	855,133	17,160	1,276,090	0	286,022	1,643,842	1,929,863	676,846	224,107	10,690	284,621	198,556	124,251	4,725,024
65-74	1,172,391	1,833,538	70,202	3,076,131	229,786	202,782	937,824	1,140,606	0	244,365	77,320	633,747	243,648	152,468	5,798,072
75+	1,649,857	2,062,081	174,506	3,886,444	5,225,881	662,679	1,623,034	2,285,713	0	863,195	15,020	295,623	567,037	354,837	13,493,751
Total	3,556,348	5,416,597	261,868	9,234,813	5,455,668	1,223,464	4,344,644	5,568,108	676,846	1,358,503	124,944	1,368,129	1,072,879	671,381	25,531,270
Person															
0-4	49,621	14,008	0	63,629	0	0	0	0	0	0	0	0	2,870	1,796	68,295
5-14	45,809	28,887	0	74,696	0	0	0	0	0	0	0	0	3,369	2,108	80,173
15-24	41,607	65,614	0	107,221	0	13,100	97,465	110,565	0	0	7,185	37,701	11,847	7,414	281,933
25-34	102,618	122,336	5,845	230,799	0	23,552	96,906	120,459	0	28,549	3,803	34,285	18,849	11,795	448,537
35-44	281,572	338,003	0	619,575	0	25,304	35,934	61,238	0	0	1,392	26,145	31,949	19,993	760,292
45-54	428,429	828,516	27,432	1,284,377	0	109,741	331,554	441,294	0	107,445	32,312	725,775	116,873	73,136	2,781,213
55-64	984,954	1,572,856	32,417	2,590,227	85,661	400,901	1,721,240	2,122,140	676,846	419,755	20,576	324,701	281,442	176,119	6,697,468
65-74	2,086,072	3,174,978	320,534	5,581,584	751,036	513,114	2,163,038	2,676,152	0	760,910	125,400	1,240,906	502,273	314,310	11,952,571
75+	2,576,980	3,155,042	549,060	6,281,082	5,399,967	969,401	1,657,613	2,627,014	282,039	1,376,493	29,060	357,481	737,585	461,562	17,552,284
Total	6,597,662	9,300,240	935,288	16,833,190	6,236,665	2,055,112	6,103,751	8,158,863	958,885	2,693,152	219,728	2,746,995	1,707,057	1,068,233	40,622,767

Table A 3 - Refractive error and accommodation
direct health costs 1993-94 ($) by age, gender and type

Age	Hospitals inpatients				Nursing homes	Medical services			Pharmaceutical			Outpatients	Other	Research	Total costs
	Public	Private	Repatriation	Total		GPs	Specialists	Total	OHPs	Prescription	Over the counter				
Male															
0-4	9,884	9,813	0	19,697	0	57,394	254,101	311,495	1,104,619	0	0	0	64,760	40,525	1,541,097
5-14	2,767	7,948	0	10,715	0	146,034	881,470	1,027,504	0	0	0	0	46,827	29,303	1,114,349
15-24	0	137,738	0	137,738	0	142,146	565,160	707,306	2,388,182	0	0	0	145,830	91,257	3,470,313
25-34	4,763	383,334	0	388,097	0	66,762	675,425	742,187	0	0	0	0	50,980	31,902	1,213,165
35-44	8,654	261,182	0	269,836	0	163,516	1,242,393	1,405,909	2,051,342	0	0	0	168,105	105,196	4,000,387
45-54	9,137	229,459	0	238,596	0	228,790	1,748,841	1,977,631	0	0	33,717	0	101,481	63,504	2,414,928
55-64	13,119	71,758	0	84,877	0	71,854	1,609,533	1,681,387	0	26,836	18,127	895,315	122,075	76,391	2,905,008
65-74	15,682	42,618	0	58,300	0	129,901	1,723,641	1,853,542	253,466	0	28,075	0	98,929	61,908	2,354,220
75+	14,198	55,625	0	69,823	0	60,623	831,052	891,675	0	0	0	0	43,367	27,138	1,032,003
Total	78,204	1,199,475	0	1,277,679	0	1,067,019	9,531,616	10,598,636	5,797,609	26,836	79,919	895,315	842,354	527,124	20,045,471
Female															
0-4	6,243	14,898	0	21,141	0	13,960	0	13,960	0	0	0	0	1,583	991	37,675
5-14	4,162	2,001	0	6,163	0	371,520	1,417,519	1,789,039	5,963,200	9,383	18,411	0	351,185	219,763	8,357,144
15-24	11,473	339,716	0	351,189	0	166,353	1,231,057	1,397,410	1,993,902	0	0	0	168,800	105,631	4,016,932
25-34	2,945	694,025	0	696,970	0	97,858	351,936	449,794	770,733	0	0	0	86,486	54,121	2,058,103
35-44	7,631	290,102	0	297,733	0	217,820	1,818,598	2,036,418	1,796,515	0	23,178	0	187,353	117,241	4,458,438
45-54	4,540	210,785	0	215,325	0	411,867	3,132,002	3,543,869	248,351	0	22,215	0	181,757	113,739	4,325,255
55-64	0	32,841	0	32,841	0	146,600	1,230,689	1,377,289	0	0	22,694	0	64,625	40,441	1,537,890
65-74	18,690	59,616	5,751	84,057	0	204,233	2,953,697	3,157,930	401,157	0	31,088	0	165,721	103,704	3,943,657
75+	27,120	83,132	0	110,252	0	158,083	2,277,529	2,435,612	0	0	0	1,580,360	186,107	116,461	4,428,792
Total	82,804	1,727,116	5,751	1,815,671	0	1,788,294	14,413,027	16,201,320	11,173,857	9,383	117,585	1,580,360	1,393,618	872,091	33,163,886
Person															
0-4	16,127	24,711	0	40,838	0	71,354	254,101	325,455	1,104,619	0	0	0	66,343	41,516	1,578,772
5-14	6,929	9,949	0	16,878	0	517,554	2,298,989	2,816,543	5,963,200	9,383	18,411	0	398,013	249,066	9,471,494
15-24	11,473	477,454	0	488,927	0	308,499	1,796,217	2,104,716	4,382,084	0	0	0	314,630	196,888	7,487,245
25-34	7,708	1,077,359	0	1,085,067	0	164,619	1,027,361	1,191,980	770,733	0	0	0	137,466	86,023	3,271,268
35-44	16,285	551,284	0	567,569	0	381,336	3,060,991	3,442,327	3,847,857	0	23,178	0	355,458	222,437	8,458,826
45-54	13,677	440,244	0	453,921	0	640,657	4,880,843	5,521,500	248,351	0	55,932	0	283,237	177,243	6,740,183
55-64	13,119	104,599	0	117,718	0	218,454	2,840,222	3,058,676	0	26,836	40,821	895,315	186,700	116,832	4,442,898
65-74	34,372	102,234	5,751	142,357	0	334,135	4,677,337	5,011,472	654,623	0	59,163	0	264,650	165,612	6,297,877
75+	41,318	138,757	0	180,075	0	218,706	3,108,581	3,327,287	0	0	0	1,580,360	229,474	143,599	5,460,795
Total	161,008	2,926,591	5,751	3,093,350	0	2,855,313	23,944,643	26,799,956	16,971,466	36,219	197,504	2,475,674	2,235,972	1,399,215	53,209,357

Table A 4 - Conjunctivitis

direct health costs 1993-94 ($) by age, gender and type

Age	Hospitals inpatients				Medical services				Pharmaceutical					
	Public	Private	Repatriation	Total	Nursing homes	GPs	Specialists	Total	OHPs	Prescription	Over the counter	Outpatients	Other	Research	Total costs
Male															
0-4	149,482	12,926	0	162,408	0	2,821,130	652,931	3,474,061	0	3,572,957	127,682	1,399,463	394,051	246,587	9,377,209
5-14	16,590	621	0	17,211	0	1,993,594	663,745	2,657,339	0	2,151,754	112,963	1,603,249	295,091	184,660	7,022,267
15-24	8,636	6,086	0	14,722	0	893,269	101,868	995,137	0	1,165,796	49,398	921,004	141,898	88,796	3,376,752
25-34	4,398	0	0	4,398	0	1,089,770	321,398	1,411,168	0	1,316,541	175,787	1,723,217	208,880	130,712	4,970,701
35-44	10,213	0	0	10,213	0	1,002,818	318,388	1,321,206	815,277	1,333,812	132,785	1,718,970	240,504	150,501	5,723,269
45-54	8,780	13,571	0	22,351	0	558,336	418,741	977,078	0	789,347	83,609	2,817,833	211,546	132,380	5,034,143
55-64	5,996	0	0	5,996	0	565,691	881,256	1,446,947	639,009	931,711	66,359	269,036	151,506	94,808	3,605,373
65-74	11,207	0	0	11,207	0	826,113	820,299	1,646,413	0	1,688,370	59,783	754,953	187,664	117,435	4,465,824
75+	10,814	4,937	0	15,751	0	369,007	804,789	1,173,795	0	631,495	42,482	187,170	92,494	57,880	2,201,068
Total	226,116	38,141	0	264,257	0	10,119,729	4,983,415	15,103,144	1,454,286	13,581,783	850,849	11,394,895	1,923,632	1,203,760	45,776,606
Female															
0-4	97,560	6,782	0	104,342	0	2,155,581	596,029	2,751,609	0	2,597,645	98,053	1,254,930	307,001	192,114	7,305,694
5-14	11,072	0	0	11,072	0	1,455,534	388,865	1,844,399	817,997	1,745,280	100,266	1,042,249	250,833	156,965	5,969,062
15-24	6,220	4,365	0	10,585	0	1,016,392	350,022	1,366,414	0	1,366,146	126,124	525,228	153,104	95,809	3,643,409
25-34	3,178	0	0	3,178	0	1,345,253	383,034	1,728,287	770,733	1,808,840	131,061	459,721	221,090	138,352	5,261,261
35-44	11,753	1,899	0	13,652	0	1,286,178	748,227	2,034,405	475,207	1,740,081	116,609	497,499	219,991	137,665	5,235,109
45-54	4,257	0	0	4,257	0	892,073	479,617	1,371,690	704,541	1,327,428	67,860	2,303,785	260,679	163,126	6,203,367
55-64	9,307	10,233	0	19,540	0	921,772	971,841	1,893,613	1,440,098	1,610,126	71,754	444,453	247,149	154,659	5,881,392
65-74	11,288	13,379	0	24,667	0	1,089,405	1,661,545	2,750,950	937,811	1,959,605	96,142	1,574,823	331,241	207,282	7,882,520
75+	32,515	18,674	0	51,189	348,392	1,300,128	1,346,527	2,646,655	488,617	2,377,223	45,448	473,476	290,061	181,513	6,902,574
Total	187,150	55,332	0	242,482	348,392	11,462,315	6,925,707	18,388,022	5,635,005	16,532,374	853,315	8,576,166	2,281,148	1,427,484	54,284,388
Person															
0-4	247,042	19,708	0	266,750	0	4,976,711	1,248,959	6,225,670	0	6,170,602	225,735	2,654,393	701,052	438,700	16,682,903
5-14	27,662	621	0	28,283	0	3,449,128	1,052,610	4,501,738	817,997	3,897,035	213,229	2,645,498	545,924	341,625	12,991,329
15-24	14,856	10,451	0	25,307	0	1,909,661	451,890	2,361,551	0	2,531,942	175,522	1,446,232	295,002	184,605	7,020,161
25-34	7,576	0	0	7,576	0	2,435,023	704,432	3,139,455	770,733	3,125,380	306,847	2,182,938	429,969	269,064	10,231,961
35-44	21,966	1,899	0	23,865	0	2,288,996	1,066,615	3,355,611	1,290,484	3,073,893	249,394	2,216,469	460,495	288,166	10,958,378
45-54	13,037	13,571	0	26,608	0	1,450,410	898,358	2,348,768	704,541	2,116,775	151,469	5,121,618	472,224	295,506	11,237,509
55-64	15,303	10,233	0	25,536	0	1,487,463	1,853,097	3,340,560	2,079,107	2,541,837	138,113	713,490	398,654	249,468	9,486,766
65-74	22,495	13,379	0	35,874	0	1,915,518	2,481,844	4,397,363	937,811	3,647,975	155,925	2,329,776	518,904	324,717	12,348,345
75+	43,329	23,611	0	66,940	348,392	1,669,135	2,151,316	3,820,450	488,617	3,008,719	87,929	660,647	382,555	239,393	9,103,642
Total	413,266	93,473	0	506,739	348,392	21,582,044	11,909,122	33,491,166	7,089,291	30,114,157	1,704,164	19,971,060	4,204,780	2,631,245	100,060,994

Table A 5 - Retinal detachments and defects
direct health costs 1993-94 ($) by age, gender and type

Age	Hospitals inpatients				Medical services				Pharmaceutical					
	Public	Private	Repatriation	Total	Nursing homes	GPs	Specialists	Total	OHPs	Prescription	Over the counter	Outpatients	Other	Research	Total costs
Male															
0-4	28,368	0	0	28,368	0	0	0	0	0	0	0	0	1,279	801	30,448
5-14	128,201	48,820	0	177,021	0	0	0	0	0	0	0	0	7,984	4,996	190,002
15-24	226,433	49,793	0	276,226	0	0	0	0	0	0	0	0	12,459	7,796	296,481
25-34	335,005	112,079	8,979	456,063	0	0	0	0	0	0	0	0	20,570	12,872	489,505
35-44	428,743	179,299	0	608,042	0	25,345	161,018	186,363	0	0	6,907	89,418	40,175	25,141	956,046
45-54	637,558	252,963	0	890,521	0	61,803	347,600	409,403	0	0	16,704	562,967	84,776	53,051	2,017,423
55-64	1,004,957	445,621	0	1,450,578	0	0	0	0	0	0	0	0	65,426	40,942	1,556,946
65-74	1,074,070	435,044	49,628	1,558,742	173,750	32,454	406,780	439,233	0	0	10,063	127,076	104,138	65,167	2,478,169
75+	520,285	181,021	30,485	731,791	0	0	0	0	0	0	0	0	33,006	20,655	785,452
Total	4,383,620	1,704,640	89,092	6,177,352	173,750	119,602	915,398	1,035,000	0	0	33,674	779,461	369,815	231,421	8,800,473
Female															
0-4	25,941	0	0	25,941	0	0	0	0	0	0	0	0	1,170	732	27,843
5-14	47,438	6,362	0	53,800	0	0	0	0	0	0	0	0	2,427	1,518	57,745
15-24	127,804	7,082	0	134,886	0	0	0	0	0	0	0	0	6,084	3,807	144,777
25-34	167,960	72,988	0	240,948	0	21,802	83,071	104,874	0	0	0	12,930	16,181	10,126	385,058
35-44	225,242	50,809	9,004	285,055	0	0	0	0	0	0	6,066	0	13,131	8,217	312,468
45-54	366,019	144,188	0	510,207	0	0	0	0	0	0	13,558	0	23,624	14,783	562,171
55-64	496,453	243,779	10,461	750,693	0	0	0	0	0	0	0	0	33,859	21,188	805,740
65-74	713,050	345,222	0	1,058,272	0	26,630	590,599	617,229	0	0	16,183	260,563	88,053	55,102	2,095,401
75+	455,103	198,451	0	653,554	0	5,517	0	5,517	0	0	0	1,316	29,786	18,639	708,811
Total	2,625,010	1,068,881	19,465	3,713,356	0	53,948	673,670	727,619	0	0	35,806	274,809	214,314	134,112	5,100,016
Person															
0-4	54,309	0	0	54,309	0	0	0	0	0	0	0	0	2,450	1,533	58,291
5-14	175,639	55,182	0	230,821	0	0	0	0	0	0	0	0	10,411	6,515	247,747
15-24	354,237	56,875	0	411,112	0	0	0	0	0	0	0	0	18,543	11,604	441,258
25-34	502,965	185,067	8,979	697,011	0	21,802	83,071	104,874	0	0	0	12,930	36,751	22,998	874,564
35-44	653,985	230,108	9,004	893,097	0	25,345	161,018	186,363	0	0	12,973	89,418	53,306	33,357	1,268,514
45-54	1,003,577	397,151	0	1,400,728	0	61,803	347,600	409,403	0	0	30,262	562,967	108,400	67,834	2,579,595
55-64	1,501,410	689,400	10,461	2,201,271	0	0	0	0	0	0	0	0	99,285	62,130	2,362,686
65-74	1,787,120	780,266	49,628	2,617,014	173,750	59,083	997,379	1,056,462	0	0	26,246	387,638	192,191	120,268	4,573,570
75+	975,388	379,472	30,485	1,385,345	0	5,517	0	5,517	0	0	0	1,316	62,792	39,294	1,494,263
Total	7,008,630	2,773,521	108,557	9,890,708	173,750	173,550	1,589,068	1,762,619	0	0	69,480	1,054,270	584,129	365,533	13,900,489

Table A 6 - Blindness

direct health costs 1993-94 ($) by age, gender and type

Age	Hospitals inpatients				Medical services				Pharmaceutical					
	Public	Private	Repatriation	Total	Nursing homes	GPs	Specialists	Total	OHPs	Prescription	Over the counter	Outpatients	Other	Research	Total costs
Male															
0-4	3,454	0	0	3,454	0	0	0	0	0	0	0	0	156	97	3,707
5-14	8,247	6,577	0	14,824	0	0	0	0	0	0	0	0	669	418	15,911
5-24	12,820	14,907	0	27,727	0	11,698	13,723	25,421	0	0	0	0	2,397	1,500	57,046
25-34	10,617	21,737	0	32,354	0	66,212	87,479	153,691	3,713,577	0	0	0	175,887	110,066	4,185,575
35-44	13,990	42,028	0	56,018	0	50,618	0	50,618	1,753,283	0	12,430	0	84,450	52,846	2,009,646
45-54	19,045	53,686	0	72,731	0	9,172	44,239	53,411	0	0	36,183	0	7,321	4,582	174,228
55-64	32,471	84,559	0	117,030	0	24,371	279,433	303,804	0	0	6,431	0	19,271	12,059	458,595
65-74	25,021	109,105	9,258	143,384	0	0	0	0	0	0	0	0	6,467	4,047	153,898
75+	50,656	142,899	0	193,555	348,172	124,160	282,671	406,830	0	0	32,652	0	44,256	27,694	1,053,159
Total	176,321	475,498	9,258	661,077	348,172	286,232	707,545	993,776	5,466,861	0	87,695	0	340,874	213,310	8,111,765
Female															
0-4	10,552	0	0	10,552	0	10,608	0	10,608	0	0	0	0	954	597	22,712
5-14	1,883	3,450	0	5,333	0	0	0	0	0	0	0	0	241	151	5,724
15-24	7,339	11,142	0	18,481	0	0	0	0	0	0	47,187	0	2,962	1,853	70,483
25-34	5,493	37,747	0	43,240	0	0	0	0	0	0	0	0	1,950	1,220	46,411
35-44	17,862	25,653	0	43,515	0	5,936	0	5,936	0	0	0	0	2,230	1,396	53,077
45-54	2,696	51,326	0	54,022	0	0	0	0	0	0	0	0	2,437	1,525	57,983
55-64	8,445	88,912	0	97,357	0	0	0	0	0	0	37,220	0	6,070	3,798	144,446
65-74	15,645	187,151	8,394	211,190	229,786	39,714	173,190	212,904	595,334	0	11,654	2,291,409	160,220	100,262	3,812,760
75+	154,486	229,398	0	383,884	1,045,176	114,735	127,658	242,393	0	0	7,707	0	75,736	47,394	1,802,290
Total	224,401	634,779	8,394	867,574	1,274,963	170,993	300,848	471,840	595,334	0	103,768	2,291,409	252,801	158,196	6,015,885
Person															
0-4	14,006	0	0	14,006	0	10,608	0	10,608	0	0	0	0	1,110	695	26,419
5-14	10,130	10,027	0	20,157	0	0	0	0	0	0	0	0	909	569	21,635
15-24	20,159	26,049	0	46,208	0	11,698	13,723	25,421	0	0	47,187	0	5,359	3,354	127,528
25-34	16,110	59,484	0	75,594	0	66,212	87,479	153,691	3,713,577	0	0	0	177,837	111,286	4,231,986
35-44	31,852	67,681	0	99,533	0	56,554	0	56,554	1,753,283	0	12,430	0	86,680	54,242	2,062,723
45-54	21,741	105,012	0	126,753	0	9,172	44,239	53,411	0	0	36,183	0	9,758	6,106	232,211
55-64	40,916	173,471	0	214,387	0	24,371	279,433	303,804	0	0	43,651	0	25,341	15,858	603,041
65-74	40,666	296,256	17,652	354,574	229,786	39,714	173,190	212,904	595,334	0	11,654	2,291,409	166,688	104,309	3,966,658
75+	205,142	372,297	0	577,439	1,393,348	238,894	410,329	649,223	0	0	40,359	0	119,992	75,088	2,855,449
Total	400,722	1,110,277	17,652	1,528,651	1,623,134	457,225	1,008,392	1,465,617	6,062,195	0	191,463	2,291,409	593,674	371,506	14,127,649

Table A 7 - Other diseases of the eye and adnexa
direct health costs 1993-94 ($) by age, gender and type

Age	Hospitals inpatients				Medical services				Pharmaceutical					
	Public	Private	Repatriation	Total	Nursing homes	GPs	Specialists	Total	OHPs	Prescription	Over the counter	Outpatients	Other	Research	Total costs
Male															
0-4	2,684,084	3,408,942	0	6,093,026	0	534,080	1,170,930	1,705,010	2,257,266	261,570	60,174	659,533	497,789	311,504	11,845,871
5-14	1,675,211	1,078,285	0	2,753,496	460,008	746,988	1,954,204	2,701,193	1,422,706	279,725	83,627	1,186,897	400,865	250,851	9,539,369
15-24	1,160,643	1,151,378	13,808	2,325,829	0	1,247,684	1,752,536	3,000,220	0	714,451	77,121	1,437,876	340,780	213,251	8,109,529
25-34	1,722,787	1,707,452	0	3,430,239	0	1,183,075	1,306,991	2,490,066	863,407	895,066	197,117	1,932,315	442,385	276,834	10,527,428
35-44	1,939,727	2,646,023	4,843	4,590,593	58,713	1,260,569	2,690,536	3,951,104	2,507,195	764,288	221,070	2,861,857	674,516	422,095	16,051,431
45-54	1,711,879	2,729,538	26,636	4,468,053	139,025	969,966	3,702,818	4,672,784	2,054,194	740,132	207,518	6,993,896	869,399	544,048	20,689,047
55-64	2,025,659	2,725,384	40,533	4,791,576	256,984	975,482	3,787,707	4,763,190	800,892	374,058	147,526	598,104	529,170	331,141	12,592,640
65-74	2,924,101	4,286,566	557,351	7,768,018	1,042,500	1,044,557	5,779,660	6,824,217	0	918,399	187,969	2,373,699	862,146	539,509	20,516,456
75+	2,706,192	3,021,070	507,239	6,234,501	3,307,633	761,358	4,148,177	4,909,535	454,902	565,507	151,601	667,939	734,810	459,826	17,486,255
n.s.	3,783	0	0	3,783	0	0	0	0	0	0	0	0	171	107	4,060
Total	18,554,066	22,754,638	1,150,410	42,459,114	5,264,863	8,723,759	26,293,558	35,017,317	10,360,562	5,513,197	1,333,723	18,712,117	5,352,031	3,349,165	127,362,088
Female															
0-4	2,529,425	1,885,354	0	4,414,779	0	427,641	1,011,183	1,438,824	0	185,913	46,210	696,399	305,898	191,423	7,279,447
5-14	1,552,597	1,409,821	0	2,962,418	0	1,099,774	2,203,100	3,302,874	0	452,140	74,228	1,544,790	376,004	235,294	8,947,748
15-24	940,558	1,313,441	4,843	2,258,842	0	972,091	1,168,193	2,140,284	1,060,586	603,231	196,905	580,911	308,543	193,078	7,342,380
25-34	1,242,906	1,553,310	0	2,796,216	0	1,145,039	3,190,264	4,335,303	2,422,888	817,588	146,964	571,375	500,214	313,021	11,903,568
35-44	1,268,003	2,599,786	6,976	3,874,765	0	1,151,244	3,105,657	4,256,901	817,125	886,024	194,139	662,666	482,230	301,767	11,475,617
45-54	1,278,363	3,226,840	4,843	4,510,046	93,554	913,598	3,562,708	4,476,306	1,151,925	592,270	168,429	4,664,006	706,166	441,901	16,804,603
55-64	1,697,996	2,717,858	15,708	4,431,562	0	719,037	5,320,302	6,039,339	2,313,758	652,130	159,518	847,562	651,470	407,673	15,503,011
65-74	2,606,711	4,057,147	81,176	6,745,034	1,838,291	1,468,351	7,060,395	8,528,746	2,176,491	1,479,046	302,286	3,959,223	1,128,903	706,439	26,864,457
75+	3,679,423	4,273,666	246,469	8,199,558	16,026,036	1,282,218	5,381,336	6,663,555	2,336,526	1,308,767	162,185	867,760	1,604,081	1,003,793	38,172,262
Total	16,795,982	23,037,223	360,015	40,193,220	17,957,881	9,178,993	32,003,139	41,182,131	12,279,298	6,977,110	1,450,863	14,394,692	6,063,508	3,794,390	144,293,094
Person															
0-4	5,213,509	5,294,296	0	10,507,805	0	961,721	2,182,113	3,143,834	2,257,266	447,484	106,383	1,355,932	803,687	502,927	19,125,319
5-14	3,227,808	2,488,106	0	5,715,914	460,008	1,846,762	4,157,305	6,004,067	1,422,706	731,866	157,855	2,731,688	776,869	486,145	18,487,117
15-24	2,101,201	2,464,819	18,651	4,584,671	0	2,219,775	2,920,729	5,140,504	1,060,586	1,317,683	274,026	2,018,787	649,323	406,330	15,451,909
25-34	2,965,693	3,260,762	0	6,226,455	0	2,328,114	4,497,256	6,825,369	3,286,295	1,712,654	344,081	2,503,690	942,599	589,855	22,430,996
35-44	3,207,730	5,245,809	11,819	8,465,358	58,713	2,411,812	5,796,193	8,208,005	3,324,320	1,650,312	415,208	3,524,523	1,156,746	723,862	27,527,048
45-54	2,990,242	5,956,378	31,479	8,978,099	232,579	1,883,563	7,265,526	9,149,089	3,206,118	1,332,403	375,947	11,657,902	1,575,564	985,948	37,493,651
55-64	3,723,655	5,443,242	56,241	9,223,138	256,984	1,694,519	9,108,009	10,802,529	3,114,649	1,026,188	307,044	1,445,665	1,180,640	738,815	28,095,651
65-74	5,530,812	8,343,713	638,527	14,513,052	2,880,791	2,512,908	12,840,055	15,352,963	2,176,491	2,397,444	490,255	6,332,922	1,991,049	1,245,948	47,380,914
75+	6,385,615	7,294,736	753,708	14,434,059	19,333,668	2,043,576	9,529,513	11,573,089	2,791,428	1,874,275	313,786	1,535,700	2,338,891	1,463,619	55,658,516
n.s.	3,783	0	0	3,783	0	0	0	0	0	0	0	0	171	107	4,060
Total	35,350,048	45,791,861	1,510,425	82,652,334	23,222,744	17,902,751	58,296,697	76,199,448	22,639,859	12,490,307	2,784,586	33,106,808	11,415,539	7,143,555	271,655,181

Table A 8 - Total diseases of the eye and adnexa
direct health costs 1993-94 ($'000) by age, gender and type

Age	Hospitals inpatients				Medical services				Pharmaceutical					
	Public	Private	Repatriation	Total	Nursing homes	GPs	Specialists	Total	OHPs	Prescription	Over the counter	Outpatients	Other	Research	Total costs
Male															
0-4	2,946	3,447	8	6,401	0	3,428	2,078	5,506	3,362	3,835	188	2,063	963	603	22,921
5-14	1,906	1,178	0	3,084	460	2,887	3,499	6,386	1,423	2,431	197	2,790	756	473	18,001
15-24	1,515	1,546	14	3,075	0	2,308	2,531	4,839	2,388	1,880	129	2,397	663	415	15,785
25-34	2,376	2,561	26	4,963	0	2,444	2,460	4,904	4,577	2,240	384	3,762	940	588	22,358
35-44	2,978	4,161	10	7,148	59	2,534	4,572	7,106	7,127	2,098	381	4,768	1,294	810	30,791
45-54	3,750	6,210	70	10,029	209	1,925	6,773	8,697	2,054	1,610	405	11,288	1,547	968	36,807
55-64	6,739	10,973	111	17,823	514	1,869	8,180	10,049	1,440	1,528	296	1,997	1,518	950	36,114
65-74	12,991	24,979	2,678	40,649	3,996	2,553	13,063	15,616	326	3,123	410	4,824	3,110	1,946	74,000
75+	14,733	28,632	3,080	46,445	13,927	2,008	10,057	12,066	737	1,739	377	1,516	3,464	2,168	82,440
n.s.	4	0	0	4	0	0	0	0	0	0	0	0	0	0	4
Total	49,939	83,687	5,997	139,622	19,164	21,955	53,213	75,168	23,434	20,486	2,766	35,406	14,255	8,920	339,222
Female															
0-4	2,708	1,933	0	4,642	0	2,608	1,607	4,215	0	2,784	145	1,951	620	388	14,743
5-14	1,658	1,481	0	3,140	0	2,927	4,009	6,936	6,781	2,207	193	2,587	985	617	23,446
15-24	1,153	1,803	5	2,961	265	2,155	2,749	4,904	3,054	1,969	375	1,106	660	413	15,708
25-34	1,546	2,637	0	4,183	0	2,633	4,091	6,724	3,964	2,654	286	1,060	851	533	20,257
35-44	1,927	3,665	37	5,628	0	2,692	5,708	8,401	3,089	2,653	347	1,185	961	601	22,864
45-54	2,636	6,438	15	9,090	374	2,262	7,282	9,545	2,105	1,947	294	7,167	1,377	861	32,759
55-64	5,587	10,937	101	16,624	1,147	2,171	9,892	12,063	4,431	2,486	354	1,695	1,750	1,095	41,645
65-74	15,234	33,461	727	49,422	6,664	3,464	16,701	20,165	4,538	3,712	657	10,395	4,310	2,697	102,559
75+	25,849	57,421	1,635	84,905	90,582	4,346	18,428	22,774	2,825	4,605	376	4,246	9,486	5,936	225,735
Total	58,298	119,776	2,520	180,595	99,032	25,259	70,469	95,728	30,787	25,016	3,026	31,393	20,999	13,141	499,716
Person															
0-4	5,654	5,380	8	11,043	0	6,035	3,685	9,721	3,362	6,618	333	4,015	1,583	990	37,664
5-14	3,565	2,660	0	6,224	460	5,813	7,509	13,322	8,204	4,638	389	5,377	1,742	1,090	41,447
15-24	2,668	3,348	19	6,035	265	4,463	5,280	9,743	5,443	3,850	504	3,503	1,323	828	31,493
25-34	3,922	5,198	26	9,147	0	5,077	6,552	11,629	8,541	4,895	670	4,823	1,791	1,121	42,615
35-44	4,904	7,826	46	12,776	59	5,227	10,280	15,507	10,216	4,751	727	5,953	2,255	1,411	53,654
45-54	6,386	12,648	85	19,119	583	4,187	14,055	18,242	4,159	3,557	699	18,455	2,923	1,829	69,566
55-64	12,325	21,910	212	34,447	1,661	4,040	18,072	22,112	5,871	4,015	650	3,692	3,268	2,045	77,759
65-74	28,225	58,440	3,406	90,071	10,660	6,017	29,764	35,781	4,864	6,835	1,067	15,220	7,419	4,643	176,559
75+	40,582	86,053	4,715	131,350	104,509	6,354	28,486	34,840	3,562	6,344	753	5,762	12,950	8,104	308,174
n.s.	7	0	0	7	0	0	0	0	0	0	0	0	0	0	7
Total	108,240	203,463	8,517	320,220	118,196	47,214	123,682	170,896	54,221	45,502	5,792	66,799	35,254	22,061	838,941

Table A 9 - Cataract
direct health costs 2004 ($) by age, gender and type

Age	Hospitals			Medical services					Pharmaceutical					
	Inpatients	Outpatients	Total hospital	Unreferred attendances	Imaging	Pathology	Other medical	Out-of-hospital medical	Prescription	Over the counter	Total	Other health professionals	Research	Total excluding aged care
Male														
0-4	0.1	0.0	0.2	-	-	-	-	-	0.0	0.0	0.0	-	0.0	0.2
5-14	0.2	-	0.2	0.0	-	0.0	0.0	0.0	0.0	-	0.0	-	0.0	0.3
15-24	0.2	-	0.2	-	-	-	-	-	0.0	-	0.0	-	0.0	0.2
25-34	0.4	0.2	0.6	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.7
35-44	1.3	0.2	1.5	0.1	0.1	0.0	0.2	0.4	0.0	0.0	0.0	-	0.1	1.9
45-54	4.5	0.8	5.3	0.0	-	-	0.3	0.3	0.0	0.0	0.0	-	0.2	5.9
55-64	12.8	0.5	13.4	0.2	-	-	1.7	2.0	0.0	0.1	0.1	-	0.6	16.0
65-74	30.7	2.1	32.8	0.4	-	-	4.0	4.4	0.1	0.2	0.2	0.1	1.3	38.8
75-84	46.0	1.2	47.2	0.5	-	0.0	5.1	5.6	0.1	0.3	0.4	-	2.5	55.7
85+	10.2	0.6	10.8	0.1	-	0.0	2.8	2.9	0.0	0.1	0.1	-	-	13.8
Total M	106.6	5.6	112.1	1.4	0.1	0.1	14.0	15.6	0.2	0.8	0.9	0.1	4.6	133.5
Female														
0-4	0.1	-	0.1	0.0	-	-	0.2	0.2	0.0	0.0	0.0	-	0.0	0.4
5-14	0.2	-	0.2	-	-	-	-	-	0.0	-	0.0	-	0.0	0.2
15-24	0.1	-	0.1	0.0	-	-	0.2	0.2	0.0	-	0.0	-	0.0	0.3
25-34	0.3	0.0	0.3	0.0	-	-	0.4	0.4	0.0	0.0	0.0	-	0.0	0.7
35-44	0.9	0.0	0.9	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-	0.0	1.0
45-54	4.0	0.2	4.2	0.1	-	0.0	1.3	1.4	0.0	0.0	0.0	-	0.2	5.8
55-64	14.1	0.3	14.5	0.2	-	0.0	1.4	1.6	0.0	0.1	0.2	-	0.5	16.7
65-74	44.1	3.5	47.6	0.6	0.0	0.1	5.6	6.4	0.1	0.3	0.3	0.8	1.7	56.8
75-84	71.3	1.9	73.2	0.6	0.1	0.2	5.8	6.7	0.2	0.4	0.5	-	6.6	87.1
85+	20.2	0.9	21.1	0.2	-	-	2.9	3.1	0.0	0.1	0.1	-	-	24.2
Total F	155.4	6.8	162.1	1.8	0.1	0.3	17.8	20.0	0.3	0.9	1.2	0.8	9.0	193.1
Person														
0-4	0.3	0.0	0.3	0.0	-	-	0.2	0.2	0.0	0.0	0.0	-	0.0	0.6
5-14	0.4	-	0.4	0.0	-	0.0	0.0	0.0	0.0	-	0.0	-	0.0	0.4
15-24	0.3	-	0.3	0.0	-	-	0.2	0.2	0.0	-	0.0	-	0.0	0.6
25-34	0.7	0.2	0.8	0.0	-	-	0.4	0.4	0.0	0.0	0.1	-	0.0	1.3
35-44	2.2	0.2	2.4	0.1	0.1	0.0	0.2	0.4	0.0	0.0	0.0	-	0.1	2.9
45-54	8.5	1.0	9.5	0.2	-	0.0	1.6	1.8	0.0	0.0	0.1	-	0.3	11.6
55-64	26.9	0.9	27.8	0.4	-	0.0	3.1	3.5	0.0	0.3	0.3	-	1.1	32.7
65-74	74.8	5.6	80.4	1.0	0.0	0.1	9.6	10.8	0.1	0.4	0.6	0.9	2.9	95.6
75-84	117.4	3.1	120.4	1.1	0.1	0.2	10.9	12.3	0.2	0.7	0.9	-	9.1	142.8
85+	30.4	1.5	31.9	0.3	-	0.0	5.6	6.0	0.0	0.1	0.2	-	-	38.0
Total	261.9	12.4	274.3	3.2	0.2	0.4	31.8	35.6	0.5	1.6	2.1	0.9	13.6	326.6

Table A 10 - Glaucoma
direct health costs 2004 ($) by age, gender and type

Age	Hospitals			Medical services					Pharmaceutical					
	Inpatients	Outpatients	Total hospital	Aged care homes	Unreferred attendances	Imaging	Pathology	Other medical	Out-of-hospital medical	Prescription	Over the counter	Total	Other health professionals	Research	Total including aged care
Male															
0-4	0.0	-	0.0	-	-	-	-	-	-	0.0	-	0.0	-	0.0	0.0
5-14	0.0	-	0.0	-	-	-	0.0	0.0	0.0	0.0	-	0.0	-	0.0	0.0
15-24	0.1	0.1	0.1	-	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.2
25-34	0.1	0.0	0.1	-	0.0	-	-	0.1	0.1	0.1	0.0	0.1	-	0.0	0.4
35-44	0.1	0.0	0.2	-	0.0	-	-	0.3	0.3	0.3	0.0	0.3	-	0.1	0.8
45-54	0.3	1.5	1.8	-	0.1	-	-	0.1	0.2	2.2	0.0	2.2	-	0.3	4.5
55-64	0.6	0.1	0.8	-	0.3	0.2	-	1.7	2.2	4.4	0.0	4.4	-	0.3	7.7
65-74	1.0	1.3	2.4	-	0.2	-	0.0	1.4	1.7	10.1	0.1	10.2	-	0.8	15.0
75-84	1.3	0.1	1.5	4.2	0.5	0.1	-	1.9	2.5	14.2	0.0	14.2	0.6	0.7	23.7
85+	0.3	0.1	0.3	3.8	0.1	-	-	1.1	1.2	2.9	0.0	2.9	0.1	-	8.4
Total M	3.9	3.3	7.2	8.0	1.3	0.3	0.0	6.5	8.2	34.2	0.2	34.4	0.8	2.2	60.7
Female															
0-4	0.0	-	0.0	-	-	-	-	-	-	0.0	-	0.0	-	0.0	0.0
5-14	0.1	-	0.1	-	-	-	-	-	-	0.0	-	0.0	-	0.0	0.1
15-24	0.0	-	0.0	-	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.1
25-34	0.0	0.0	0.1	-	0.0	-	-	0.1	0.1	0.1	0.0	0.1	-	0.0	0.3
35-44	0.1	0.0	0.2	-	0.1	-	-	0.3	0.4	0.6	0.0	0.6	-	0.0	1.3
45-54	0.2	0.3	0.6	-	0.1	-	0.0	0.5	0.5	0.9	0.0	0.9	-	0.1	2.1
55-64	0.6	0.8	1.4	0.1	0.2	-	0.0	1.4	1.6	4.3	0.0	4.3	1.7	0.8	9.9
65-74	1.2	1.3	2.5	-	0.4	0.1	0.0	2.6	3.0	11.3	0.2	11.5	-	0.7	17.7
75-84	1.8	0.5	2.4	3.4	0.5	-	-	3.0	3.5	16.3	0.0	16.3	-	2.1	27.7
85+	0.6	0.3	0.8	15.4	0.2	-	-	1.4	1.6	6.5	0.0	6.5	-	-	24.3
Total F	4.7	3.3	8.0	18.9	1.5	0.1	0.0	9.3	10.9	39.9	0.3	40.2	1.7	3.8	83.5
Person															
0-4	0.1	-	0.1	-	-	-	-	-	-	0.0	-	0.0	-	0.0	0.1
5-14	0.1	-	0.1	-	-	-	0.0	0.0	0.0	0.0	-	0.0	-	0.0	0.1
15-24	0.1	0.1	0.2	-	0.0	-	-	0.0	0.0	0.1	0.0	0.1	-	0.0	0.3
25-34	0.1	0.1	0.2	-	0.0	-	-	0.2	0.2	0.2	0.0	0.2	-	0.1	0.6
35-44	0.3	0.1	0.3	-	0.1	-	-	0.6	0.7	0.9	0.0	0.9	-	0.1	2.0
45-54	0.5	1.8	2.3	-	0.2	-	0.0	0.6	0.8	3.0	0.1	3.1	-	0.4	6.7
55-64	1.2	0.9	2.1	0.1	0.5	0.2	0.0	3.1	3.9	8.7	0.1	8.7	1.7	1.1	17.6
65-74	2.2	2.6	4.9	-	0.6	0.1	0.0	3.9	4.7	21.3	0.3	21.6	-	1.5	32.7
75-84	3.2	0.7	3.9	7.6	1.0	0.1	-	4.9	6.0	30.4	0.1	30.5	0.6	2.8	51.4
85+	0.9	0.3	1.2	19.2	0.3	-	-	2.5	2.8	9.4	0.0	9.4	0.1	-	32.7
Total	8.6	6.6	15.2	27.0	2.8	0.4	0.1	15.8	19.0	74.1	0.5	74.6	2.4	6.0	144.2

Table A 11 - Refractive error
direct health costs 2004 ($) by age, gender and type

Age	Hospitals inpatients			Medical services					Optometry	Pharmaceutical			Other health professionals	Research	Total excluding aged care
	Inpatients	Outpatients	Total hospital	Unreferred attendances	Imaging	Pathology	Other medical	Total out-of-hospital medical		Prescription	Over the counter	Total			
Male															
0-4	0.0	-	0.0	0.0	-	-	0.0	0.0	0.7	0.0	-	0.0	2.0	0.3	3.0
5-14	0.0	-	0.0	0.1	-	-	1.3	1.4	8.4	0.0	-	0.0	-	0.2	10.1
15-24	0.1	-	0.1	0.1	-	0.0	0.6	0.7	6.7	0.0	-	0.0	4.4	0.6	12.6
25-34	0.4	-	0.4	0.1	-	-	0.6	0.7	7.5	0.0	-	0.0	-	0.2	8.9
35-44	0.5	-	0.5	0.1	-	-	0.9	1.0	10.2	0.0	-	0.0	4.1	0.8	16.5
45-54	0.6	-	0.6	0.1	-	-	1.6	1.7	17.8	0.0	0.1	0.1	-	0.5	20.7
55-64	0.3	2.5	2.8	0.1	-	-	0.9	1.0	13.9	0.0	0.1	0.1	-	0.7	18.5
65-74	0.1	-	0.1	0.1	-	-	0.7	0.8	9.4	0.0	0.1	0.1	0.5	0.5	11.3
75-84	0.2	-	0.2	0.1	-	-	0.8	0.9	4.0	0.0	-	0.0	-	0.3	5.3
85+	0.0	-	0.0	0.0	-	-	0.9	0.9	1.0	0.0	-	0.0	-	-	1.9
Total M	2.3	2.5	4.8	0.8	-	0.0	8.3	9.2	79.7	0.0	0.2	0.2	10.9	4.1	108.9
Female															
0-4	0.0	-	0.0	-	-	-	0.1	0.1	0.7	0.0	-	0.0	-	0.0	0.8
5-14	0.0	-	0.0	0.2	-	-	1.0	1.2	9.4	0.0	0.0	0.0	11.3	1.6	23.5
15-24	0.2	-	0.2	0.1	-	-	1.0	1.2	12.5	0.0	-	0.0	3.6	0.7	18.2
25-34	0.5	-	0.5	0.1	-	-	0.6	0.7	12.4	0.0	-	0.0	1.4	0.4	15.3
35-44	0.5	-	0.5	0.1	-	-	1.1	1.2	15.0	0.0	0.1	0.1	3.6	0.9	21.2
45-54	0.5	-	0.5	0.2	0.1	-	1.8	2.0	21.8	0.0	0.1	0.1	0.6	1.0	26.0
55-64	0.2	-	0.2	0.1	-	-	0.9	1.0	15.8	0.0	0.1	0.1	-	0.4	17.5
65-74	0.2	-	0.2	0.1	-	-	1.1	1.2	10.7	0.0	0.1	0.1	0.8	0.7	13.5
75-84	0.2	2.0	2.2	0.0	-	-	0.7	0.7	7.1	0.0	-	0.0	-	1.1	11.1
85+	0.0	2.3	2.3	0.0	-	-	0.8	0.8	2.2	0.0	-	0.0	-	-	5.3
Total F	2.4	4.3	6.7	0.9	0.1	-	9.0	10.0	107.5	0.1	0.3	0.4	21.3	6.7	152.5
Person															
0-4	0.0	-	0.0	0.0	-	-	0.1	0.2	1.4	0.0	-	0.0	2.0	0.3	3.8
5-14	0.0	-	0.0	0.3	-	-	2.3	2.6	17.8	0.0	0.0	0.0	11.3	1.8	33.5
15-24	0.3	-	0.3	0.3	-	0.0	1.6	1.9	19.2	0.0	-	0.0	8.0	1.3	30.8
25-34	0.9	-	0.9	0.2	-	-	1.2	1.4	19.9	0.0	-	0.0	1.4	0.6	24.2
35-44	1.0	-	1.0	0.2	-	-	2.0	2.2	25.2	0.0	0.1	0.1	7.7	1.7	37.8
45-54	1.2	-	1.2	0.3	0.1	-	3.4	3.7	39.6	0.0	0.1	0.1	0.6	1.6	46.7
55-64	0.6	2.5	3.1	0.2	-	-	1.8	1.9	29.8	0.0	0.1	0.1	-	1.1	36.0
65-74	0.3	-	0.3	0.2	-	-	1.7	1.9	20.1	0.0	0.1	0.1	1.3	1.2	24.9
75-84	0.3	2.0	2.4	0.1	-	-	1.5	1.6	11.1	0.0	-	0.0	-	1.3	16.4
85+	0.1	2.3	2.3	0.0	-	-	1.7	1.7	3.1	0.0	-	0.0	-	-	7.2
Total	4.7	6.8	11.4	1.7	0.1	0.0	17.3	19.2	187.1	0.1	0.5	0.6	32.2	10.9	261.3

Table A 12 - Age-related macular degeneration
direct health costs 2004 ($) by age, gender and type

Age	Hospitals			Medical services					Pharmaceutical					
	Inpatients	Outpatients	Total hospital	Unreferred attendances	Imaging	Pathology	Other medical	Out-of-hospital medical	Prescription	Over the counter	Total	Other health professionals	Research	Total excluding aged care
Male														
0-4	0.0	0.0	0.0	-	-	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0
5-14	0.0	-	0.0	0.0	-	0.0	0.2	0.2	0.0	-	0.0	-	0.0	0.2
15-24	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0
25-34	0.0	0.0	0.0	0.0	-	-	0.3	0.3	0.0	0.0	0.0	-	0.0	0.3
35-44	0.0	0.0	0.0	0.0	-	-	0.3	0.3	0.0	0.0	0.0	-	0.0	0.4
45-54	0.0	0.0	0.1	0.0	-	-	0.1	0.1	0.0	0.0	0.0	-	0.0	0.2
55-64	0.2	0.0	0.2	0.0	-	-	0.2	0.2	0.0	0.0	0.0	-	0.0	0.5
65-74	0.4	0.0	0.4	0.0	-	-	0.8	0.8	0.1	0.0	0.1	0.0	0.1	1.3
75-84	0.3	0.0	0.3	0.1	-	-	1.2	1.3	0.2	0.0	0.2	0.1	0.1	2.0
85+	0.0	0.0	0.0	0.0	-	-	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.3
Total M	1.0	0.1	1.1	0.2	-	0.0	3.3	3.5	0.3	0.0	0.3	0.1	0.2	5.2
Female														
0-4	-	-	-	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0
5-14	0.0	-	0.0	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0
15-24	0.0	-	0.0	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0
25-34	0.0	0.0	0.0	0.0	-	-	0.3	0.3	0.0	0.0	0.0	-	0.0	0.3
35-44	0.0	0.0	0.0	0.0	-	-	0.2	0.2	0.0	0.0	0.0	-	0.0	0.2
45-54	0.1	0.0	0.1	0.0	-	0.0	0.7	0.7	0.0	0.0	0.0	-	0.0	0.8
55-64	0.3	0.0	0.3	0.1	-	0.0	1.8	1.9	0.0	0.0	0.0	0.3	0.1	2.6
65-74	0.7	0.1	0.8	0.1	-	0.0	1.5	1.6	0.2	0.0	0.2	0.1	0.1	2.8
75-84	0.3	0.0	0.3	0.2	-	0.0	2.1	2.3	0.5	0.0	0.5	-	0.1	3.2
85+	0.1	0.0	0.1	0.1	-	0.0	1.0	1.1	0.0	0.0	0.0	-	0.1	1.3
Total F	1.5	0.1	1.6	0.4	-	0.1	7.6	8.1	0.8	0.0	0.8	0.3	0.5	11.4
Person														
0-4	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0
5-14	0.0	-	0.0	0.0	-	0.0	0.2	0.2	0.0	0.0	0.0	-	0.0	0.2
15-24	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0
25-34	0.0	0.0	0.0	0.0	-	-	0.6	0.6	0.0	0.0	0.0	-	0.0	0.6
35-44	0.0	0.0	0.0	0.0	-	-	0.5	0.5	0.0	0.0	0.0	-	0.0	0.6
45-54	0.1	0.0	0.1	0.0	-	0.0	0.8	0.8	0.0	0.0	0.0	-	0.0	1.1
55-64	0.5	0.1	0.5	0.1	-	0.0	2.0	2.1	0.1	0.0	0.1	0.3	0.1	3.1
65-74	1.1	0.1	1.2	0.1	-	0.0	2.3	2.4	0.3	0.0	0.3	0.1	0.2	4.1
75-84	0.6	0.0	0.6	0.3	-	0.0	3.3	3.6	0.6	0.0	0.7	0.1	0.2	5.2
85+	0.1	0.0	0.1	0.1	-	0.0	1.2	1.3	0.1	0.0	0.1	0.0	0.1	1.6
Total	2.5	0.3	2.7	0.6	-	0.1	10.9	11.6	1.1	0.0	1.1	0.4	0.7	16.5

Table A 13 - Other diseases of the eye and adnexa
direct health costs 2004 ($) by age, gender and type

Age	Hospitals inpatients			Medical services						Pharmaceutical					
	Inpatients	Outpatients	Total hospital	Aged care homes	Unreferred attendances	Imaging	Pathology	Other medical	Total out-of-hospital medical	Prescription	Over the counter	Total	Other health professionals	Research	Total excluding aged care
Male															
0-4	9.3	20.6	30.0	-	4.0	-	0.2	4.7	8.8	1.8	2.8	4.7	19.8	0.5	63.7
5-14	6.5	12.1	18.5	-	4.6	0.5	0.2	5.8	11.1	2.7	2.2	4.9	15.1	0.4	50.0
15-24	8.1	3.2	11.2	-	4.9	0.9	0.4	2.9	9.0	2.7	0.5	3.2	0.3	0.1	23.9
25-34	8.1	15.9	24.1	-	7.0	0.5	0.2	5.6	13.4	3.9	0.9	4.8	11.3	0.2	53.8
35-44	12.7	8.4	21.1	-	8.2	0.9	0.9	5.7	15.7	5.1	1.1	6.2	9.1	0.2	52.3
45-54	16.5	17.5	33.9	-	8.4	1.6	1.1	10.1	21.3	5.6	1.2	6.8	5.5	0.3	67.8
55-64	20.9	3.4	24.3	-	8.6	1.5	1.2	8.9	20.1	6.4	0.7	7.1	13.8	0.3	65.7
65-74	17.3	9.1	26.4	3.0	6.6	1.4	0.5	10.3	18.8	6.5	0.7	7.2	11.5	0.3	67.2
75-84	16.7	1.1	17.9	10.8	5.1	0.4	0.3	8.7	14.5	5.8	0.4	6.2	4.1	0.2	53.7
85+	3.9	0.6	4.5	9.3	1.6	0.1	0.1	5.7	7.4	1.3	0.1	1.4	1.3	-	23.9
Total M	120.1	91.8	211.9	23.1	59.0	7.7	5.1	68.3	140.1	41.9	10.7	52.6	91.7	2.6	522.1
Female															
0-4	6.9	11.8	18.7	-	3.7	0.1	0.2	3.3	7.3	2.0	1.8	3.7	15.1	0.4	45.2
5-14	5.5	10.8	16.3	-	4.2	0.3	0.2	3.9	8.7	2.4	2.6	5.0	4.6	0.3	34.9
15-24	5.2	5.1	10.3	-	6.7	0.5	0.7	3.7	11.7	4.1	1.0	5.0	3.0	0.1	30.1
25-34	8.7	1.4	10.1	-	9.6	1.4	0.8	7.8	19.6	7.1	0.9	8.0	5.4	0.2	43.3
35-44	13.0	3.4	16.4	-	13.0	2.2	1.3	11.1	27.6	9.8	1.2	11.1	2.5	0.2	57.7
45-54	16.4	12.2	28.7	-	12.8	3.2	1.3	10.6	27.9	10.5	1.0	11.5	6.7	0.3	75.1
55-64	16.0	2.4	18.4	0.2	9.7	2.4	0.7	11.2	24.0	8.8	1.1	9.9	6.6	0.2	59.3
65-74	15.1	13.0	28.1	0.8	8.2	2.0	0.9	11.4	22.4	9.3	0.9	10.2	9.0	0.3	70.9
75-84	16.8	3.8	20.5	10.5	7.6	1.1	0.4	9.9	19.0	9.3	0.5	9.8	8.8	0.5	69.2
85+	6.2	2.1	8.3	39.0	3.2	0.3	0.1	7.0	10.7	3.2	0.2	3.4	3.7	-	65.1
Total F	110.0	66.0	176.0	50.4	78.7	13.6	6.6	80.0	178.8	66.5	11.1	77.6	65.4	2.5	550.8
Person															
0-4	16.3	32.4	48.7	-	7.6	0.1	0.4	8.0	16.1	3.8	4.6	8.4	34.9	0.8	108.9
5-14	11.9	22.9	34.8	-	8.8	0.8	0.4	9.7	19.7	5.1	4.8	9.9	19.7	0.7	84.9
15-24	13.3	8.3	21.6	-	11.6	1.4	1.1	6.6	20.7	6.8	1.5	8.2	3.2	0.3	54.0
25-34	16.9	17.3	34.2	-	16.6	1.9	1.0	13.4	33.0	11.0	1.8	12.8	16.7	0.4	97.1
35-44	25.8	11.8	37.6	-	21.2	3.1	2.2	16.8	43.3	15.0	2.3	17.3	11.5	0.4	110.1
45-54	32.9	29.7	62.6	-	21.2	4.8	2.4	20.7	49.1	16.2	2.2	18.4	12.2	0.5	142.9
55-64	37.0	5.8	42.7	0.2	18.3	3.9	1.9	20.0	44.1	15.2	1.8	17.0	20.4	0.5	125.0
65-74	32.4	22.2	54.6	3.7	14.9	3.3	1.3	21.7	41.2	15.8	1.6	17.4	20.5	0.6	138.0
75-84	33.5	4.9	38.4	21.3	12.7	1.5	0.8	18.6	33.5	15.1	0.9	16.0	12.9	0.8	122.9
85+	10.1	2.7	12.8	48.4	4.8	0.4	0.2	12.7	18.1	4.5	0.3	4.8	5.0	-	89.0
Total	230.1	157.8	387.9	73.5	137.7	21.3	11.7	148.3	318.9	108.4	21.8	130.2	157.1	5.1	1,072.8

Table A 14 - Total diseases of the eye and adnexa
direct health costs 2004 ($) by age, gender and type

Age	Hospitals				Medical services						Pharmaceutical					
	Inpatients	Outpatients	Total hospital	Aged care homes	Unreferred attendances	Imaging	Pathology	Other medical	Total out-of-hospital medical	Optometry	Prescription	Over the counter	Total	Other health professionals	Research	Total including aged care
Male																
0-4	9.5	20.6	30.2	-	4.0	-	0.2	4.7	8.9	0.7	1.8	2.8	4.7	21.8	0.8	67.0
5-14	6.8	12.1	18.8	-	4.7	0.5	0.3	7.3	12.7	8.4	2.7	2.2	4.9	15.1	0.6	60.6
15-24	8.5	3.3	11.7	-	5.1	0.9	0.4	3.4	9.8	6.7	2.7	0.5	3.3	4.6	0.8	36.9
25-34	9.1	16.1	25.2	-	7.2	0.5	0.2	6.6	14.5	7.5	4.1	0.9	5.0	11.3	0.5	64.1
35-44	14.7	8.6	23.3	-	8.4	1.0	0.9	7.4	17.7	10.2	5.4	1.1	6.5	13.1	1.1	72.0
45-54	21.9	19.8	41.7	-	8.7	1.6	1.1	12.3	23.7	17.8	7.9	1.3	9.2	5.5	1.3	99.2
55-64	34.9	6.6	41.5	-	9.3	1.8	1.2	13.4	25.6	13.9	10.8	0.9	11.8	13.8	1.9	108.5
65-74	49.6	12.6	62.2	3.0	7.4	1.4	0.5	17.2	26.5	9.4	16.7	1.1	17.7	12.1	2.9	133.8
75-84	64.6	2.4	67.1	15.0	6.2	0.5	0.4	18.0	25.1	4.0	20.2	0.8	21.0	4.8	3.8	140.9
85+	14.4	1.2	15.6	13.1	1.9	0.1	0.1	10.7	12.7	1.0	4.3	0.2	4.5	1.4	0.0	48.4
Total M	234.0	103.3	337.3	31.1	62.8	8.2	5.2	101.0	177.2	79.7	76.6	12.0	88.5	103.6	13.8	831.2
Female																
0-4	7.1	11.8	18.9	-	3.7	0.1	0.2	3.7	7.7	0.7	2.0	1.8	3.7	15.1	0.4	46.4
5-14	5.7	10.8	16.5	-	4.5	0.3	0.2	4.9	9.9	9.4	2.5	2.6	5.1	15.9	1.9	58.6
15-24	5.6	5.1	10.7	-	6.8	0.5	0.7	5.0	13.1	12.5	4.1	1.0	5.1	6.6	0.9	48.8
25-34	9.5	1.5	10.9	-	9.7	1.4	0.8	9.2	21.1	12.4	7.2	0.9	8.1	6.8	0.6	59.9
35-44	14.6	3.5	18.0	-	13.2	2.2	1.3	12.7	29.4	15.0	10.5	1.3	11.8	6.1	1.2	81.5
45-54	21.3	12.8	34.0	-	13.2	3.3	1.3	14.9	32.7	21.8	11.4	1.1	12.5	7.3	1.6	110.0
55-64	31.4	3.5	34.9	0.3	10.3	2.4	0.7	17.1	30.5	15.8	13.1	1.3	14.5	8.6	2.1	106.7
65-74	61.4	17.9	79.2	0.8	9.4	2.1	1.0	22.3	34.8	10.7	20.9	1.4	22.3	10.7	3.5	162.0
75-84	90.5	8.3	98.8	13.9	9.0	1.2	0.6	21.8	32.6	7.1	26.3	0.9	27.2	8.8	10.4	198.8
85+	27.1	5.5	32.6	54.4	3.6	0.3	0.2	13.3	17.4	2.2	9.8	0.2	10.0	3.7	0.1	120.4
Total F	274.2	80.5	354.7	69.4	83.4	13.8	7.0	125.0	229.2	107.5	107.7	12.6	120.3	89.6	22.6	993.2
Person																
0-4	16.6	32.4	49.0	-	7.7	0.1	0.4	8.4	16.6	1.4	3.8	4.6	8.4	36.9	1.1	113.4
5-14	12.5	22.9	35.3	-	9.2	0.8	0.4	12.2	22.6	17.8	5.1	4.9	10.0	31.0	2.5	119.2
15-24	14.1	8.3	22.4	-	11.9	1.4	1.1	8.4	22.8	19.2	6.8	1.5	8.3	11.2	1.7	85.7
25-34	18.5	17.6	36.1	-	16.9	1.9	1.0	15.8	35.6	19.9	11.2	1.8	13.1	18.2	1.1	124.0
35-44	29.2	12.1	41.3	-	21.6	3.2	2.2	20.1	47.1	25.2	15.9	2.4	18.3	19.2	2.3	153.4
45-54	43.2	32.6	75.7	-	21.9	4.9	2.4	27.2	56.4	39.6	19.2	2.5	21.7	12.8	2.9	209.2
55-64	66.3	10.1	76.4	0.3	19.6	4.2	1.9	30.5	56.1	29.8	24.0	2.3	26.3	22.4	3.9	215.2
65-74	111.0	30.5	141.5	3.7	16.8	3.4	1.5	39.6	61.3	20.1	37.6	2.5	40.0	22.8	6.4	295.8
75-84	155.2	10.7	165.8	28.9	15.2	1.7	1.0	39.8	57.7	11.1	46.5	1.7	48.2	13.6	14.3	339.7
85+	41.5	6.7	48.3	67.6	5.5	0.4	0.3	24.0	30.1	3.1	14.1	0.4	14.5	5.1	0.1	168.8
Total	508.1	183.8	692.0	100.5	146.2	22.0	12.2	226.0	406.4	187.1	184.3	24.5	208.8	193.2	36.4	1,824.43

Eye Research Australia

32 Gisborne St, East Melbourne, Victoria 3002

Tel: 61 3 9929 8360 Fax: 61 3 9662 3859

Email: cera-info@unimelb.edu.au

Website: www.cera.org.au

ABN: 72 076 481 984