Cataract treatment in Australia

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Report by Access Economics Pty Limited for

Alcon Laboratories Australia Pty Ltd

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Acknowledgements

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Glossary

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
AMA	Australian Medical Association
AWE	average weekly earnings
BDES	Beaver Dam Eye Study
BMES	Blue Mountains Eye Study
B(S)CVA	best (spectacle) corrected visual acuity
CE(A)	cost effectiveness analysis
CERA	Centre for Eye Research Australia
DALY	disability adjusted life year
DOHA	Department of Health and Ageing
ECCE	conventional extracapsular cataract extraction
GDP	gross domestic product
HASA	health ageing savings account
I-A	irrigation-aspiration
ICCE	intracapsular cataract extraction
ICER	incremental cost effectiveness ratio
IOL	intraocular lens
MBS	Medicare Benefits Schedule
MO	macular oedema
MVIP	Melbourne Visual Impairment Project
NHS	National Health Survey
NPV	net present value
OBPR	Office of Best Practice Regulation
PMMA	polymethyl methacrylate
PSC	posterior sub-capsular
QALY	quality adjusted life year
VSL(Y)	value of a statistical life (year)

Executive Summary

This report provides an overview of current cataract treatment in Australia, the cost effectiveness of cataract surgery generally and a cost effectiveness analysis (CEA) of a standard compared to a novel treatment protocol. From this we draw conclusions regarding financing vehicles for cataract surgery with an emphasis on consumer choice.

Prevalence of cataract and associated visual impairment

A cataract is a clouding of the eye's lens that causes the blurring of normal vision and visual impairment. Progression of cataract can cause inflammation, pain, headaches and visual impairment, with associated morbidity from accidents, falls and fractures, depression and a higher relative risk of death.

In Australia, the Australian Institute of Health and Welfare (AIHW) estimates that cataract accounts for approximately 40% of all people with visual acuity less than 6/12 and 12% of blindness (less than 6/60). Based on AIHW data, Access Economics estimates that cataract affects more than 1.8 million people in 2009.

- Prevalence rates increase from 2.3% in Australians aged 40-49 to 76% in those aged 80 or more.
- Visual impairment from cataract increases from 0.1% in the 60-69 year age group to 15.2% in the population over 90.
- Demographic ageing over coming decades will result in those blind from cataract increasing to 10,707 by 2024, and those with visual impairment from cataract increasing to 118,750 people by 2024, if there is no change in treatment and prevention activity.

In 2009, cataract health system costs are around $385 million, with substantial other economic and wellbeing impacts.

Incidence of cataract surgery

Visual impairment and other adverse health symptoms from cataract can be prevented through cataract surgery. Of all people with cataract, around half require surgery at any point in time (Taylor, 2001). However, there are a number of factors that contribute to the incidence of cataract surgery – the safety and efficacy of the procedure, people's expectations, financing and access considerations. Over time, surgery has gradually been occurring earlier in the progression process, which can reduce the burden of disease and economic consequence of visual impairment from cataract in Australia.

- Panchapakesan et al (2003) estimated an overall five-year cataract surgery rate of 5.7%, increasing from 0.3% in people aged 49-54 to 17.4% among those aged 75 or older.

Developments in cataract treatment

Most cataract surgery in Australia is performed using phacoemulsification (a form of extracapsular cataract extraction), which removes the cataract and implants an intraocular lens (IOL) into the eye.

Over the last decade, there have been major advances in cataract surgery including advances in anaesthesia for cataract surgery, new incision techniques, new phacoemulsification technologies, IOL material design and management of cataract surgery complications. For example, monofocal IOLs are now foldable, providing faster recovery time as well as aspheric lenses that reduce high order aberrations to improve night driving.

Effectiveness of cataract surgery, with and without visual comorbidity

Cataract surgery is a highly effective procedure which, in most cases, significantly increases the patient's visual acuity and quality of life. A New Zealand (Riley et al, 2002) study mapped the pre-operative and post-operative improvement in best-corrected visual acuity by severity of visual impairment showing 71% had visual impairment before but only 12% after.

If people with cataract have other visually impairing conditions – e.g. diabetic eye disease, macular degeneration, glaucoma, presbyopia etc – cataract surgery may not restore sight to the same degree. The rate of serious complications as a result of cataract surgery is low, although intra-operative events have been reported in around 5% of cases and can be affected by the presence of diabetes.

People with cataract can also have astigmatism, defined as an irregularity in the curvature of the cornea caused by tension and pressure on the eyeball. A minor level of astigmatism is normal and requires no correction. A person who has both cataract and a corneal astigmatism will not regain high-quality distance vision after cataract surgery unless the astigmatism is also corrected. American data suggest that some 20% of patients who need cataract surgery have a clinically significant degree of pre-existing astigmatism.

Advanced procedures in lens development (toric IOLs) can correct for mild or severe cases of astigmatism as well as the removal of cataract. Studies have shown that toric IOLs effectively improve visual acuity and quality of life in astigmatism patients compared to conventional mono-focal IOLs (Mendicute et al, 2008).

Australian data (CERA, 2009) suggest that for eyes without co-morbid ocular conditions, around 95% of cataract surgeries will significantly improve vision, but if the person has other vision problems the improvement is less than 80%. A large UK study (Desai et al (1999) showed 92% and 77% restoration of sight respectively, while a much smaller US data specifically related to astigmatism showed that surgery with toric lenses restored sight in 84% of cases while with traditional spherical IOLs the restoration was only 76%.

Cost effectiveness of cataract surgery

Cataract surgery has been comprehensively shown – across many studies – to be highly cost effective (e.g. Baltussen et al, 2004). One form of CEA is cost utility analysis (CUA), where the outcome metric is 'quality adjusted life years' (QALYs) gained or 'disability adjusted life years' (DALYs) averted.

The World Health Organization (2002) defines cost effectiveness relative to gross domestic product (GDP) per capita as:

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

Other cost effectiveness benchmarks include DoHA (2003) of $60,000/QALY or the Value of a Statistical Life Year (VLSY) benchmark of $151,000.

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

CEA of novel surgery (toric lenses) vs. traditional IOL for people with astigmatism

Access Economics undertook a CEA of a novel cataract surgery protocol (toric lens) versus a traditional IOL protocol for Australians with astigmatism. A Markov model was used with modelling in TreeAge software. The surgical pathways for the two cataract treatment protocols were prepared in consultation with a clinical reference group. Cost data were based on a weighted average of Medicare Benefits Schedule (MBS) fees (September 2009) and recommended AMA fees, together with industry data on IOLs and glasses.

- The traditional pathway involved the cost of a standard IOL ($350), a standard surgery ($2,337.25 per eye) and the lifetime cost of glasses that correct astigmatism ($1,552.23).
- The novel treatment involved the cost of a toric IOL ($600), a slightly more complex toric procedure (3,474.35 per eye) and a 5% risk of repeat surgery to rotate the lens (5% of $662.25), as well as the cost of glasses with no need for astigmatism correction ($1,293.53).
- Using a weighted average of the efficacy data above and AIHW DALY weights for mild, moderate and severe visual impairment, full sight was restored for 91.5% of eyes with toric lenses and 75.8% without, so the QALY outcome associated with novel treatment was 0.98743 and with standard treatment was 0.96415.

The results from the TreeAge model showed standard cataract treatment is cheaper but less effective (in terms of QALYs) compared to the novel treatment protocol. The cost effectiveness (CE) of standard treatment was $4,397/QALY whereas the CE of novel treatment was $5,470/QALY. The incremental cost effectiveness ratio (ICER) of novel treatment was $49,890/QALY and as such it proves to be a cost effective intervention by all three criteria.

Financing conclusions

The challenges of demographic ageing, which increase cataract prevalence, highlight the need for new approaches to prevent and treat cataract, including how best to finance this treatment.

- Cataract treatment in Australia has been improving health outcomes over time (with safety improvements evident in the bring-forward of the intervention time), as new technologies and techniques are introduced – however, these new protocols are not less costly necessarily (as shown above). At the same time, Access Economics analysis of MBS data shows that relevant MBS fees have been reduced 80% over the past two decades. There is no evidence to suggest that the operation time has been cut to 20% of the time taken in 1987 and, even if so, operation time is only part of the story. The fee for the item covers an average of 2.81 post-operative care consultations as well – and the cost of the lens.

- The 2009-10 Budget changes are likely to have a significant impact on areas where there is more reliance on public finding (e.g. rural and remote regions as well as indigenous areas). The changes mean that people with cataract will have to foot even more of the bill for surgery – even though the procedure is cost effective. Those that can no longer afford to pay for access to cataract surgery at an appropriate stage will wait in public hospital queues, with the associated high economic and social costs – loss of productivity, quality of life and the burden on carers due to loss of independence (inability to read, drive, cook, and so on).

Moreover, with recent developments in cataract surgery (such as those using toric lenses to treat cataract as well as astigmatism), quality of life after treatment can be increased even further in future. Novel developments in cataract treatment (represented in this analysis by the example of use of toric lenses) are also a cost effective way of treating cataract compared to established or standard treatment protocols.

- Given the cost effectiveness of current and novel cataract treatment, there is a strong argument for continued public funding support – including through MBS subsidies.
- In particular, the cost effectiveness of toric lenses that remedy astigmatism as well as the benefits of multifocal lenses that address presbyopia provide an argument for MBS funding through a specific item number for these novel services. Another option might be to allow public patients to be able to access novel IOLs by paying a gap in public hospitals.

Finally, it is clear that decisions to reduce public funding in ad hoc ways is not in the best long term policy interest. Reform of health financing is overdue and, as the National Health and Hospital Reform Commission has recommended, there is a strong case for maintaining a mixed public-private financing system. This requires cultivating strong private sector involvement and adopting appropriate financing vehicles. For provisioning that is highly likely as cataract is, insurance (for catastrophic events) is less relevant than savings products. Also, those that have the capacity to pay, should be encouraged to provision. A final recommendation, then, is the incremental introduction of long term sustainable solutions, such as Healthy Ageing Savings Accounts.

Access Economics

1 Introduction

Access Economics was commissioned by Alcon Laboratories Australia to provide an analysis of cataract treatment in Australia, with the following scope of issues:

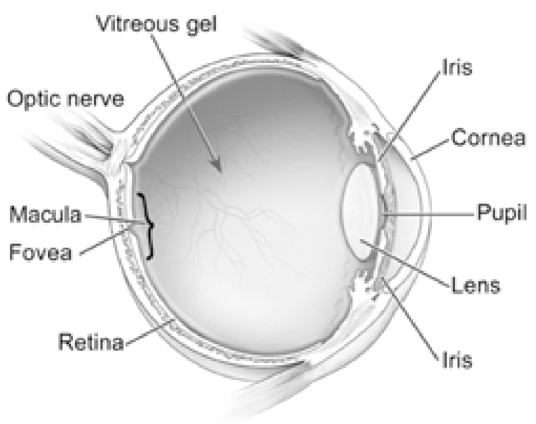
- an overview of current cataract treatment in Australia (Chapter 2);
- an evidence-based review of the cost effectiveness of cataract surgery generally compared to other surgical interventions (Chapter 3);
- an evidence-based review of the cost effectiveness of new technologies and techniques that deliver better health outcomes from cataract surgery, with a cost effectiveness analysis (CEA) of standard compared to novel treatment (Chapters 4 and 5); and
- conclusions in the context of financing vehicles for cataract surgery with an emphasis on consumer choice (Chapter 6).

The remainder of this chapter provides contextual background to that analysis.

1.1 Overview

The leading cause of visual impairment worldwide is cataract of the lens (Resnikoff et al, 2004). A cataract is a clouding of the eye's lens that causes the blurring of normal vision (Figure 1.1). Cataract develops when some of the protein clumps together and clouds a small area of the lens. When the lens becomes opaque, the amount of light that passes through it is reduced and scattered, and the image cannot be correctly focused on the retina at the back of the eye (AIHW, 2005).

Figure 1.1: Diagram of the human eye



Source: National Eye Institute (2009).

People with cataract can also have astigmatism, defined as an irregularity in the curvature of the cornea caused by tension and pressure on the eyeball. Current cataract treatment can remove cataracts as well as correct for astigmatism and thus improve vision.

1.2 Visual impairment

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 of vision) 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) (Taylor et al, 2005).

Legal blindness in Australia is defined as distance vision acuity of worse than 6/60 in the better eye with correction (i.e. with the use of glasses or contact lenses) or a visual field of less than 10°, or both (Taylor et al, 2005). 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 is defined as the reduced ability to distinguish differences in shade or colour. Total blindness refers to people who are unable to see light. Severity stages of visual impairment are defined in Table 1.1.

> This report is primarily concerned with visual impairment and is defined as visual acuity that less than driving vision, <6/12.

Table 1.1: Stages of visual impairment

Disease stages	Visual acuity
Early disease stage	Better than 6/12
Mild Impairment	6/12 to 6/18
Moderate Impairment	<6/18 to 6/60
Severe or profound Impairment	<6/60

Taylor et al (2005).

1.3 Cataract symptoms

The onset of cataract is not usually detected immediately as the lens becomes gradually cloudy until vision becomes unclear. This can take from a few months to several years to develop and can affect both eyes at the same time (Baltussen et al, 2003).

Cataracts usually develop at different rates in each eye with the person experiencing symptoms such as those following.

- **Blurry vision**. This occurs when protein in the eye clumps up clouding the lens and reducing the light that reaches the retina. The cloudy vision reduces the sharpness of the image.
- **Colour vision**. The clear lens slowly changes to a yellowish/brownish colour, adding a brownish tint to vision. Objects appear washed, dull and not as vibrant as normal vision.

- **Second sight and unstable prescription**. Improvements in near vision may be experienced in some cases, although this is usually short lived as the cataract grows.
- **Light sensitivity.** Abnormal **d**iscomfort experienced on exposure of eyes to light.
- **Double vision**. Seeing two images rather than one.

In its early stages, cataract is not a dangerous eye condition (Fink et al, 1999) but if allowed to progress to become visually impairing it can contribute to accidents such as falls and fractures (Black and Wood, 2005), as well as depression (Burmedi et al , 2002). An over-mature cataract can cause inflammation and pain, and some people can also experience headaches.

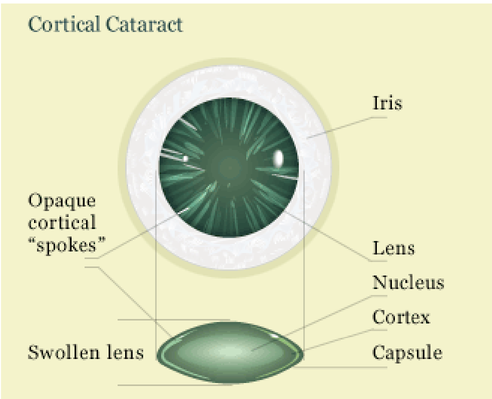
1.4 Varying forms of cataract

There are three main types of cataract, defined by location on the lens of the eye, and usually detected through a dilated pupil with an ophthalmoscope[1] or slit lamp[2]. People with cataracts can have more than one type of cataract at any point in time.

Cortical cataract forms in the lens cortex (the outside of the lens) and gradually extends its spokes to the centre. It is the most common form of cataract linked with diabetes (Figure 1.2).

- The Blue Mountain Eye Study[3] (BMES) found cortical cataract was 20% more prevalent in females and was also linked to a history of diabetes, previous heart attack and a blood factor (fibrinogen) association. Protective factors included regular alcohol consumption, higher dietary polyunsaturated food (e.g. fish, cereal etc) and the use of post-menopausal hormonal therapy by women.

Figure 1.2: Cortical cataract



Source: CataractSurgery.com (2009).

[1]An ophthalmoscope is an instrument that enables a doctor to examine the inside of a person's eye. The instrument has an angled mirror, various lenses, and a light source. With it, an ophthalmologist or optometrist can see the retina, the optic nerve, the retinal veins and arteries.

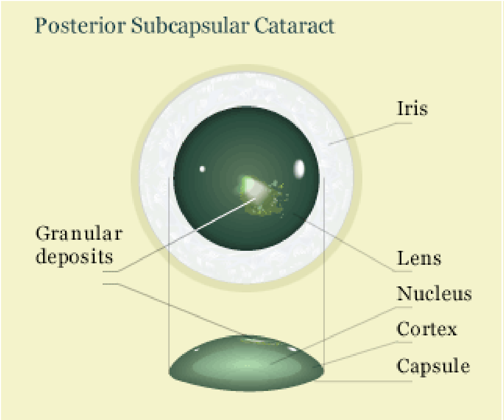
[2]The slit lamp is a table-mounted binocular microscope that shines a light into the eye to allow the doctor to examine the entire eye under high magnification. The slit lamp has better optics than the direct ophthalmoscope, providing magnification and a three-dimensional view, which allows measurement of depth.

[3]The BMES was a population-based survey of non-institutionalised residents aged 49 years and older from two postcode urban areas in the Blue Mountains region, west of Sydney, New South Wales.

Posterior sub-capsular (PSC) cataract forms at the back of the lens and has also been implicated with diabetes (Figure 1.3).

- The BMES identified many important associations with PSC cataract, including sunlight exposure, smoking, diabetes, higher dietary salt and, particularly, long-term use of inhaled steroids.[4]

Figure 1.3: Posterior sub-capsular cataract

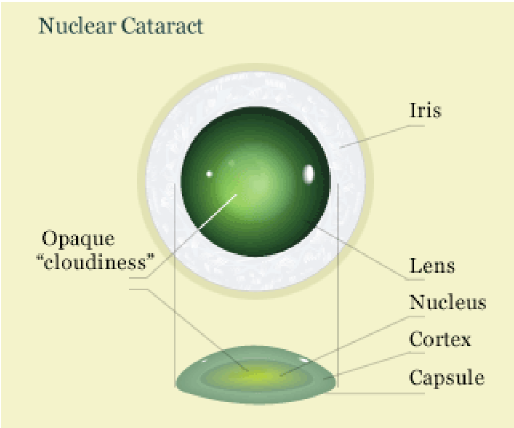


Source: CataractSurgery.com (2009).

Nuclear cataract forms in the centre of the lens and is due mainly to ageing (Figure 1.4).

- The BMES showed that smoking, heavy alcohol consumption, sunlight exposure and diabetes increased the risk of nuclear cataract – while nutritional factors (higher levels of protein, vitamin A and B) appeared to reduce the risk of developing nuclear cataract by approximately 40%.

Figure 1.4: Nuclear cataract



Source: CataractSurgery.com (2009).

In summary, ageing is the primary cause of cataract although studies have also shown other substantial risk factors.

- **Age and sex**: The prevalence of cataract, like most types of vision impairment, increases as people get older, and is also higher in women than in men (McCarty et al, 1999; AIHW, 2008). Gender differences are likely to be related to hormonal factors.

[4] Centre for vision research, accessed on the 9 September, 2009 (http://www.cvr.org.au/bmes.htm#findings).

  - Oestrogen and hormone replacement therapy may play a protective role in reducing the incidence of age-related cataract (Younan et al, 2002). The Beaver Dam Eye Study (BDES, Klein et al, 1997)[5] found that early age of menarche (i.e. first menstrual period), duration of oestrogen therapy, and ever-use of the oral contraceptive pill protect against formation of nuclear cataract.

- **Congenital cataract**: Like many illnesses, genetic susceptibility or ethnicity may make some people more at risk of cataract.
- **Secondary cataract:** In additional to risk from long-term exposure to sunlight, cigarette smoking (Spangler et al, 2008) and diabetes (Section 1.4), cataract may also be a secondary consequence of steroid use (oral, topical or inhalational) (National Eye Institute, 2002; Kanthan et al, 2009; McCarty et al, 1999).
- **Traumatic cataract**: traumatic cataract may develop after various types of ocular insult, including blunt or perforating trauma as well as ionizing, infrared, or ultraviolet radiation (Zakrzeweski and Ahmed, 2004).

1.5 Prevalence of cataract

In 2002, the number of visually impaired people globally was estimated at 161 million (Resnikoff et al, 2008), up from an estimated 38 million in 1990 (Thylefors et al, 1995). Cataract steadily increased as a cause of blindness to nearly 48% in 2002 (Resnikoff et al, 2008).

In Australia, cataract accounts for approximately 40% of all people with vision less than 6/12 and 12% of blindness (AIHW, 2005). The AIHW estimated that in 2004, untreated cataract affected almost 1.46 million Australians aged 55 years and older. The prevalence rates generally increase with age with more than 32% of those affected being over the age of 80 (Table 1.2).

Table 1.2: Prevalence estimates of cataract for Australia, 2004

	Rates (%)			Number ('000)		
	Men	Women	People	Men	Women	People
40-49	2.8	1.9	2.3	41.4	28.5	69.9
50-54	4.9	5.0	5.0	32.3	33.3	65.6
55-59	8.2	9.4	8.8	49.8	56.2	106.0
60-64	13.8	16.9	15.3	63.2	75.9	139.0
65-69	22.4	27.7	25.1	82.5	104.6	187.2
70-74	33.9	41.0	37.6	101.7	133.6	235.3
75-79	47.2	54.7	51.3	116.3	165.0	281.3
80+	71.3	76.6	74.7	178.1	333.5	511.6
Total	**15.2**	**20.0**	**17.7**	**665.4**	**930.5**	**1,595.9**
Total 55+	**26.5**	**34.9**	**31.0**	**591.7**	**868.7**	**1,460.4**

Source: AIHW (2005).

Applying the AIHW 2004 data in Table 1.2 to the latest demographic data from Access Economics (2009) indicates that **cataract will affect more than 1.8 million people in 2009** (see Table 1.3).

[5] The Beaver Dam Eye Study is a population-based study of age-related eye diseases in people 43-86 years of age.

The prevalence of cataract increases from approximately 2.3% of people aged 40-49 to 76% of those aged 80 years and over.

The analysis in Section 5 focuses solely on people over the age of 55 noting that among those with cataract, 92% are over the age of 55 years.

Table 1.3: Prevalence estimates of cataract for Australia, 2009

	Rates (%)			Number		
	Men	Women	People	Men	Women	People
40-49	2.8	1.9	2.3	42,985	29,531	72,516
50-54	4.9	5.0	5.0	34,982	36,383	71,365
55-59	8.3	9.5	8.9	53,467	62,241	115,709
60-64	13.9	16.9	15.4	81,331	99,125	180,456
65-69	22.6	27.9	25.3	97,581	122,499	220,080
70-74	33.9	41.0	37.5	112,047	145,645	257,692
75-79	47.4	55.2	51.6	120,857	162,881	283,738
80+	73.0	78.0	76.0	229,625	390,170	619,796
Total	**15.7**	**20.5**	**18.0**	**772,875**	**1,048,476**	**1,821,351**
Total 55+	**27.1**	**34.7**	**31.1**	**694,908**	**982,561**	**1,677,469**

Source: Access Economics (2009) and AIHW (2005).

The 2007-08 National Health Survey (NHS) self-reported data show cataract is under-reported as affecting only 338,000 Australians aged 55 years and older in 2004. Consistent with the AIHW data in Table 1.2 and Table 1.3, NHS prevalence rates increased with age, with females reporting a higher prevalence rate than their male counterparts. Lower prevalence estimates based on self-reported data could reflect lack of awareness (e.g. due to comorbid dementia).

1.5.2 Prevalence of visual impairment from cataract

Combined data from the Melbourne Visual Impairment Project (MVIP) and BMES showed that 68,657 Australians were visually impaired from cataract of whom 9% or 6,111 people were blind in 2004 (Table 1.4).

Prior to age 50, cataract is a relatively rare cause of visual impairment. After that, prevalence is estimated to increase 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 to 10,707 by 2024, and those with visual impairment from cataract increasing to 118,750 people by 2024, if there is no change in treatment and prevention activity.

Table 1.4: 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 (2004) derived from MVIP, BMES and ABS population data.

In a recent analysis of pooled eye health data from population-based clinical studies, conducted both in Australia and internationally, it was estimated that 9.4% of Australians aged 55 or older are visually impaired and about 1.2% are blind (AIHW, 2005). The combined impact of an ageing Australian population and the high age correlation of causes of vision loss indicates that the prevalence of visual impairment is set to increase over time in a policy-neutral environment (Access Economics, 2004).

1.6 Natural progression

Robust data describing the five-year progression of cataract are reported by McCarty et al (2002) in a study involving around 2,500 participants, which found that progression of cataract varies considerably with age. While in some cohorts progression rates were higher among women, differences were not statistically significant.

- Progression was defined as more than a 2/16 increase in the visual acuity of the eye. Over a five year period this could mean that a person with perfect eyesight would progress to having a moderate impairment, as defined in Table 1.1.
- The overall progression rates of the three types of cataract were not significantly different. As there were only 45 cases of PSC cataract at baseline with available follow-up data, age- and sex-specific rates could not be calculated. Overall, however, the progression rate in this group was 20.0% (8.7–31.3). The overall progression rates for cortical and nuclear cataract were 14.3% (10.2–18.3) and 19.3% (15.9–22.7) respectively, although, as already noted, differences were not statistically significant.

Table 1.5: Age-specific, five-year progression of cortical and nuclear cataract

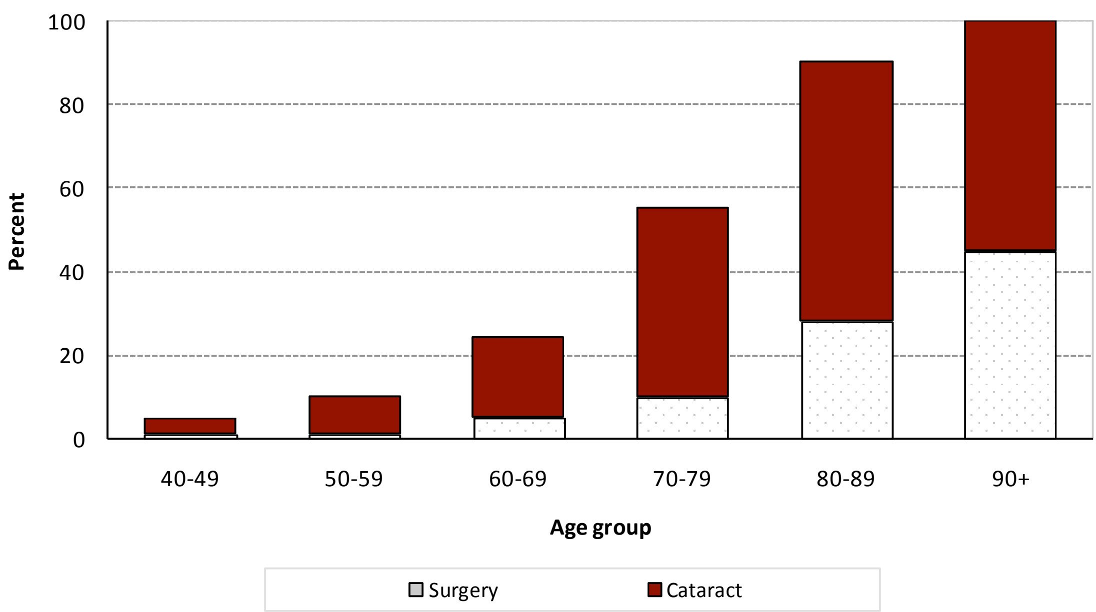
Age	Cortical cataract		Nuclear cataract	
	No. at risk	% (95% CI)	No. at risk	% (95% CI)
40-49	20	10.0 (0.88-19.1)	604	9.3 (6.6-12.0)
50-59	66	19.7 (11.6-27.8)	735	12.7 (9.1-16.3()
60-69	141	12.8 (6.5-10.1)	586	23.6 (18.7-28.4)
70-79	109	15.6 (8.4-22.8)	257	47.5 (39.9-55.0)
80+	36	8.3 (0.18-16.5)	51	43.1 (35.4-50.8)
Total	**372**	**14.3 (10.2-18.3)**	**2,233**	**19.3 (15.9-22.7)**

Source: Sex-specific rates are reported in the original work by McCarty et al (2002).

1.7 Incidence of cataract surgery

Taylor (2001) indicated that approximately half of all people with cataract require surgery, with the proportion requiring surgery increasing with age. Taylor (2003) forecast that the need for cataract surgery would double in 20 years, from around 160,000 annual cataract operations at the time – an overall surgery rate of 0.8% of the Australian population.

Chart 1.1 : Demographic distribution of cataract in Australians over 40 years of age



Source: Taylor (2001).

There are a number of factors that contribute to the incidence of cataract surgery. Principal among these is the visual acuity threshold for cataract surgery. Over the last 50 years, the acuity threshold for has fallen from 6/60 to 6/24 then to 6/18 and is now often less than 6/9 or less (Taylor, 2000). The number of cataract operations increases 2.5 times as the acuity criterion changes from less than 6/60 to less than 6/24 and fivefold if it goes to less than 6/12 (i.e. driving vision). As patients' expectations increase, and the ability of technology to safely and effectively fulfil these expectations expands, more and more operations are being undertaken, which can reduce the burden of disease and economic consequence of visual impairment from cataract in Australia.

Another factor critical to cataract surgery rates is surgical coverage or uptake – the proportion of those who actually have surgery when they need it. Indeed, if a health system does not have the capacity to undertake surgery where required, cataract can be left untreated causing a divergence in clinical need and surgical intervention.

Using BDES data, Klein et al (1997) found the overall incidence rate of cataract surgery in the United States in people aged 49 and older was 4.5% in males and 7.6% in females, with the highest rate in the oldest age-group (75 to 86 years). The difference between genders was attenuated after adjusting for age. No significant difference in the incidence of cataract surgery was observed between left and right eyes.

The incidence of cataract surgery in the Australian setting has been analysed in a five year study undertaken by Panchapakesan et al (2003). The study included 2,335 participants and documented an overall five-year cataract surgery rate of 5.7% in first or both eyes (those with previous cataract surgery were excluded). The incidence of cataract surgery in first or both eyes increased from 0.3% in people aged 49-54 years at baseline to 17.4% among those aged 75 years or older. Table 1.6 below compares these BMES (Panchapakesan et al, 2003), with findings from the Beaver Dam Eye Study (Klein et al, 1997), showing a reasonably close accord in incident cataract surgery rates between the two studies.

Table 1.6: Comparison of 5 year cataract surgery rates between the BMES and the BDES

Cohort	Eyes at risk BMES	Surgical cases BMES	Incidence % (95% CI)	
			BMES	BDES
Total				
49-54	328	1	0.3 (0.0-0.9)	0.8
55-64	824	14	1.7 (0.8-2.6)	3.0
65-74	784	62	7.9 (6.0-9.8)	12.2
75+	282	49	17.4 (12.9-21.8)	19.8
Total	**2218**	**126**	**5.7 (4.7 – 6.6)**	**6.3**
Women				
49-54	180	0	0	
55-64	467	10	2.1 (0.813.5)	
65-74	456	39	8.6 (5.9 – 11.1)	
75+	174	28	16.1 (4.7-7.3)	
Total	1277	77	6.0 (4.7-7.3)	
Men				
49-54	148	1	0.7 (0.0-2.0)	
55-64	357	4	1.1 (0.2-2.2)	
65-74	328	23	7.0 (4.3-9.8)	
75+	108	21	19.4 (11.7-26.8)	
Total	941	49	5.2 (3.8-6.6)	

Source: Panchapakensan et al, (2003).

1.8 The impact of cataract

The five main causes of vision loss in Australia are uncorrected or under-corrected refractive error (62%), cataract (14%), age related macular degeneration (10%), diabetic eye disease (2%) and glaucoma (3%) (Access Economics, 2004).

Eye disease and vision loss have considerable financial and social costs to the Australian community. Visual impairment can shorten life, increase the risk of other conditions, restrict social participation and independence, and impair physical and mental health. In addition, people with visual impairment have a higher use of social services and higher admission rate to nursing homes (Access Economics, 2004).

Reduced quality of life is also associated with cataract, both as a result of the morbidity (inability to perform simple tasks due to poor vision) and co-morbidity (associated depression). Premature mortality is not considered in this report since it is relatively uncommon, although can be associated with falls, fractures and depression attributable to visual impairment (Access Economics, 2004).

There are a number of financial and broader economic costs associated with the impact of a person living with severe cataract. This includes greater health system utilisation (including health system costs such as consultations with ophthalmologists and hospitalisation).

Access Economics (2004) estimated that the total direct health system costs of visual impairment in 2004 were $1.8 billion. This was more than the cost of coronary heart disease, stroke, arthritis or depression. It represented more than health spending on two National Health Priority areas - diabetes and asthma - combined.

- Of this spending, 18% (or $327 million) was attributed to cataract expenditure.
- **In 2009 dollars this cataract health system expenditure impact would increase to around $385 million after inflating for average health inflation of 3.3% per year.**

2 Cataract treatment

2.1 Diagnosing cataract

Cataract is usually diagnosed by a general practitioner or optometrist, although other professionals can also detect the initial formation of cataract.

Cataract can be detected through standard visual acuity tests. Letters of varying sizes are required to be read from a Snellen chart[6], with eyes tested individually and together, to measure visual acuity at different distances (Table 2.1). This test screens for any visual problems, including cataracts – with advantages being that it is easy, painless, and quick. However, more tests may be necessary to confirm the formation of cataracts.

Frequently pupil dilation is used. Eye drops are used to widen the pupils so that the back of the eye can be examined. A hand held torch with a lens (ophthalmoscope) or a slit-lamp is used to examine the clarity of the lens within each eye. The dilation usually takes 15-20 minutes. An ophthalmologist is then consulted if the initial consultation indicates that the lens is opaque, cloudy or discoloured.

Table 2.1: Snellen chart measures of visual acuity

Snellen	Metric
20/10	6/3
20/15	6/4.5
20/20	6/6
20/25	6/7.5
20/30	6/9
20/40	6/12
20/50	6/15
20/100	6/30
20/200	6/60

Source: MDsupport.org (2009).

2.2 History

Historically, surgical treatment for cataract dates back to the 5th century BC, where practices were known as 'couching'. In this procedure, the lens affected by cataract was surgically removed from the pupil and placed in the back of the eye. Vision, however was still blurred due to the unavailability of corrective lenses. Development has progressed steadily since then.

In 1748, Jacques Daviel was the first European physician to successfully extract cataracts from the eye. In the 1940s Harold Ridley introduced the concept of implantation of the intraocular lens (IOL) which permitted more efficient and comfortable visual rehabilitation possible after cataract surgery.

[6] The chart and the letters are named for a 19th-century Dutch ophthalmologist Hermann Snellen (1834–1908) who created them as a test of visual acuity. The Snellen eye chart has a series of letters or letters and numbers, with the largest at the top. As the person being tested reads down the chart, the letters gradually become smaller.

In 1967, Charles Kelman introduced phacoemulsification, a technique that uses ultrasonic waves to emulsify the nucleus of the crystalline lens in order to remove the cataracts without a large incision. This new method of surgery decreased the need for an extended hospital stay and made the surgery relatively simple.

2.3 Current treatment for cataract

The treatment decision for the individual patient with cataract depends on the extent of visual impairment. For an early cataract, different spectacles, magnifying lenses, or stronger lighting may improve vision. However, such treatment is purely remedial and does not mitigate the natural progression of the cataract itself.

If the individual has few functional limitations as the result of the cataract and surgery is not indicated, it may be appropriate to follow the patient at 4 to 12-month intervals to evaluate eye health and vision and to determine whether functional disability develops (American Optometric Association, 2004).

At a certain point, based on visual acuity and patient concern (e.g. interference with daily activities), or because the cataract is preventing examination of another eye problem such as diabetic retinopathy, cataract surgery may be required. While benchmarks such as visual acuity worse than 6/12 may be used as indicators for cataract surgery, primarily it is the degree to which the cataract interferes with the individual's lifestyle that determines whether cataract surgery is undertaken. As such, incident cataract surgery is undertaken right through the disease stages, depending on the individual's sensitivity to this impairment. With recent advances in technology, the safety of cataract surgery has improved significantly and hence the visual impairment threshold at which cataract surgery is undertaken has fallen.

Currently, there are three main forms of cataract surgery: phacoemulsification, extracapsular extraction and intracapsular extraction (discussed below). In all three cases, surgery is generally performed as day surgery without general anaesthetic, with a six-week total recovery period. In recent years, phacoemulsification has emerged as the preferred method of treatment, with the AIHW national morbidity database showing that more than 90% of cataract surgeries in Australia are undertaken using this method.

2.4 Types of surgery

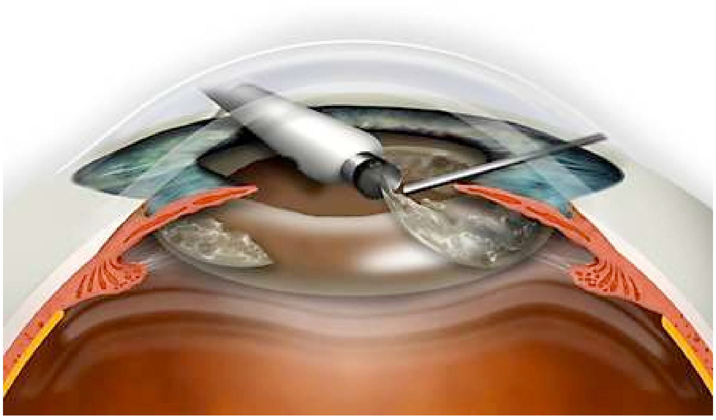
Cataract extraction involves the removal of almost the entire natural lens. There are two main types of cataract surgery.

- **Intracapsular cataract extraction (ICCE)** involves the removal of the lens and the surrounding lens capsule in one piece. After surgery, special eyeglasses are provided to patients to restore sight. The procedure has a relatively high rate of complications due to the large incision required and pressure placed on the vitreous body. It has therefore been largely superseded and is rarely performed in countries where operating microscopes and high-technology equipment are readily available.
- **Extracapsular cataract extraction (ECCE)** involves extraction of the lens only while the elastic lens (posterior) capsule is left intact to allow implantation of an IOL.
  - **Conventionally** this occurs through a large (usually 10–12 mm) incision made in the cornea or sclera. Although it requires a larger incision and the use of stitches, the conventional method may be indicated for patients with very hard cataracts or other situations in which phacoemulsification is problematic.

- **Phacoemulsification** (Figure 2.1) is usually the preferred method. It involves the use of a machine with an ultrasonic hand piece equipped with a titanium or steel tip. The tip vibrates at ultrasonic frequency (40,000 Hz) and the lens material is emulsified. A second fine instrument may be used from a side port to facilitate cracking or chopping of the nucleus into smaller pieces. Fragmentation makes emulsification easier, and aspiration of cortical material (the soft part of the lens around the nucleus). After phacoemulsification of the nucleus and cortical material is completed, a dual irrigation-aspiration (I-A) probe or a bimanual I-A system is used to aspirate out the remaining peripheral cortical material.

Currently cataract surgery improves the sight of adults in 95% of all cases and can have a profound impact on quality of life. The remaining 5% (McPhee et al, 2008) suffer from post operative complications (Section 2.7 lists side-effects).

Figure 2.1: Phacoemulsification



Source: Dambrosio Eye Care (2009).

2.5 Types of lenses

After the removal of the cataract, an IOL is usually implanted into the eye, either through a small incision (1.8 mm to 2.8 mm) using a foldable IOL, or through an enlarged incision, using a PMMA (polymethyl methacrylate) lens. The foldable IOL, made of silicone or acrylic material of appropriate power is folded either using a holder/folder, or a proprietary insertion device provided with the IOL. Previously, IOLs contained a pair of little spring-loaded loops to hold the lens in place; however most IOLs are now foldable, which makes insertion easier. Various intraocular lens materials are detailed below.

Table 2.2: Various intraocular lens material

1. Polymethyl methacrylate (PMMA) IOL			
2. Silicone IOL (foldable)			
	a. Single piece plate type		
		i.Spherical	ii.Toric
	b. Three-piece		
		i. Monofocal	ii. Multifocal
3. Acrylic IOL (foldable)			
	a. Hydrophobic		b. Hydrophilic

Source: *Evidence based approach* in Cataract surgery (2004).

Many people with cataract also have some degree of astigmatism – when the surface of the cornea is curved in such a way that vision becomes distorted or blurred. A minor level of astigmatism is normal and requires no correction. A person who has both cataracts and a corneal astigmatism will not regain high-quality distance vision after cataract surgery unless the astigmatism is also corrected. The American Academy of Ophthalmology estimated that 15-29% of patients with cataract also have some degree of astigmatism. United States data from STAAR Surgical stated that approximately 20% of patients who need cataract surgery have a clinically significant degree of pre-existing astigmatism (corneal astigmatism or lenticular astigmatism)[7].

Advanced procedures in lens development (toric IOLs) can correct for mild or severe cases of astigmatism as well as the removal of cataract. In addition to toric IOLs, other options of correcting for astigmatism can include limbal relaxing incisions and laser vision correction.

Studies have shown that toric IOLs effectively improve visual acuity and quality of life in astigmatism patients compared to conventional mono-focal IOLs (Mendicute et al, 2008). Chapter 5 of this report compares the cost effectiveness of conventional mono-focal lenses to toric lenses for people with both cataract and astigmatism requiring surgery.

2.6 The effectiveness of cataract surgery

Cataract surgery is a highly effective procedure which, in most cases, significantly increases the patient's visual acuity and quality of life. If the eye is healthy, the likelihood is that cataract surgery will restore good vision. In eyes without co-morbid ocular conditions, around 95% of operations to remove a cataract will result in significantly improved vision[8]. Visual acuity outcomes may be slightly better in eyes undergoing phacoemulsification than in those undergoing other surgery, particularly in eyes with concurrent diabetic retinopathy. However, differences are only minor.

In recent research using data from the BMES, Panchapakesan et al (2004) assessed the change in visual acuity following cataract surgery in a cohort of 2,218 people. During the 5-year follow up, 126 people or 5.7% of participants underwent cataract surgery in their first or both eyes. The mean gain in visual acuity from cataract surgery, after accounting for the effects of age and the presence of early age-related maculopathy, was 6.06 logMAR[9] letters in right eyes and 8.58 logMAR letters in left eyes. This converts to a gain of around only one line of Snellen acuity and is hence relatively modest. However, this result is likely to substantially understate the efficacy of cataract surgery, as in many eyes visual acuity at time of *surgery* was likely worse than that recorded (sometimes years earlier) at *baseline*.

In research based on findings from the Auckland Cataract Study, Riley et al (2002) prospectively analysed the impacts of cataract surgery on a cohort of 480 subjects (488 eyes). The majority of surgery (97.3%) was performed by small incision phacoemulsification with post-operative unaided visual acuity, best corrected visual acuity (BCVA) and best spectacle

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[7] STAAR Surgical Company – Toric lenses (2009): http://www.staar.com/html/toric-iol.html (accessed on 9 September 2009).

[8] Centre for Eye Research Australia (CERA) (2009) http://www.cera.org.au/eyehealth/cataract.html (accessed on 9 September 2009).

[9] Logmar refers to the logarithm of the minimal angle of resolution and is a precise method of measuring visual acuity.

corrected visual acuity (BSCVA) recorded following the procedure. Table 2.3 shows that cataract surgery was very effective in restoring vision (as measured by BSCVA).

Table 2.3: Efficacy of cataract surgery in the Auckland Cataract Study

	Pre-operative (% total)	BSCVA post operative (% total)
Better than 6/12	29%	88%
6/12-6/60	47%	11%
6/60 or worse	24%	1%

Source: Riley et al (2002).

Desai et al (1999) used data from more that 100 unselected UK hospital eye units, capturing the experiences of more than 18,000 patients who underwent cataract surgery, to analyse the efficacy and safety of the procedures involved.

- Their findings indicated that for those patients without ocular co-morbidity, 85% achieved a visual acuity of 6/12 or better on discharge from postoperative follow up. In patients with serious co-existing eye disease, 65% achieved this level of acuity at this time. At discharge from postoperative follow-up, a visual acuity of 6/12 or better was achieved in 67% of patients with glaucoma, 59% of patients with age related macular disease and in 56% of patients with diabetic retinopathy.
- At final testing, 92% of patients without ocular comorbidity and 77% of patients with ocular comorbidity achieved 6/12 or better visual acuity. The study also identified risk indicators for poor visual outcome (less than 6/120 at discharge from postoperative hospital follow-up), identifying patients with diabetes as being less likely to achieve post operative acuity of 6/12 or better (OR=1.6 1.4-1.8).

Research into the effectiveness of cataract surgery can also be broadened to include the correction of astigmatism in cataract surgery. Xiao-Yi Sun et al (1998) examined whether toric IOLs used in cataract surgery corrected for astigmatism in 130 eyes. The results show that in toric IOL patients, 84% of eyes achieved better than 20/40 vision whereas in the spherical IOL group (non-toric) only 76% achieved 20/40 or better vision.

2.7 Side effects of treatment

Risks of cataract surgery include anaesthetic and surgical complications. Serious complications include endophthalmitis, retinal detachment and haemorrhage, decreased vision and blindness, and general complications associated with surgery in the elderly. Overall, the rate of serious complications as a result of cataract surgery is low, although as discussed below, adverse intra-operative events have been reported in around 5% of cases (and diabetes may be implicated in increased risk of adverse events).

Riley et al (2002) found that in a cohort of 480 elderly New Zealand subjects (488 eyes) who underwent cataract surgery, approximately 5% sustained an adverse intra-operative event. The posterior capsular rupture rate was 4.9%, and iris prolapse/iris trauma occurred in 4.3% of cases. The most common adverse event on the day following surgery was intraocular pressure (4.3% of cases) and four weeks after surgery, suture-induced astigmatism had occurred in 5.8% of cases.

Compared to the findings of Riley et al (2002), the rate of adverse events observed by Desai et al (1999) in their observational account of the experiences of approximately 18,000 patients in the UK are relatively high. Overall, 7.5% of patients experienced some form of complication during cataract surgery, the most common being capsule rupture and vitreous loss. During the 48-hour post operative period, 23.3% of all patents had one of more complications, with the most frequently occurring being corneal oedema (9.5%), raised intraocular pressure (7.9%) and uveitis (5.6%). Within three months of surgery, the rate of endophthalmitis was 0.1% and the rate of retinal detachment or tear was also 0.1%. Both intra-operatively and post operatively, there was no appreciable difference in the rate of complications between phacoemulsification and extracapsular extraction.

3 The cost effectiveness of cataract surgery

3.1 Cost effectiveness and cost utility

> *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)*

Cost effectiveness analyses (CEAs) aim to compare the value derived from an intervention – in natural units rather than dollars – with the associated costs of the intervention (in dollars).

One form of CEA is cost utility analysis (CUA), where the outcome metric is 'quality adjusted life years' (QALYs) gained or 'disability adjusted life years' (DALYs) averted. QALYs measure not just increases in length of life but also improvements in quality of life, while DALYs similarly reflect both morbidity and premature mortality components. Gold et al (2002) details the various differences between the metrics and there is also a summary in Section 5.1.1.

There is a variety of opinion on where bounds for cost effective interventions lie. The World Health Organization (2002)[10] defines cost effectiveness relative to gross domestic product (GDP) per capita as:

- **cost effective**: one to three times GDP per capita to avert one lost DALY (for Australia in 2009, around A$50,000 to A$150,000 per DALY averted);
- **very cost effective**: less than GDP per capita to avert one lost DALY (for Australia in 2009, less than A$50,000/DALY averted).

Brown et al (2004) uses an old (1982) benchmark 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.

There have been a number of studies that have established the cost effectiveness of interventions in cataract control (Laidlaw, 1998; Sach, 2007). The World Bank report titled *Investing in Health* detailed that interventions costing less than $100 per DALY saved exist only for cataracts, anaemia, and cancers of the respiratory system and cervix (World Bank, 2003).

Vision 2020 estimated that, in developing countries, cataract surgery can cost as little as US$15-32 per DALY saved, and the provision of spectacles/lenses are also highly cost effective. In the United States, 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).

Kobelt et al (2002) analysed five hundred people who had cataract scheduled for cataract extraction in one eye at four centres in Sweden during March 1999. They were asked to

[10] http://www.who.int/choice/costs/CER_levels/en/index.html

complete a preference-based quality-of-life instrument and a disease-specific disability measure, before surgery. Multiple regression analysis was used to study the correlation between utility and visual acuity and/or disability and utility and QALY gain through the intervention estimated. Using the discounted benefit rate of 3% the cost utility of cataract surgery was determined to be US$4,800/QALY.

In a unique study that evaluated the cost effectiveness of intra-capsular and extra-capsular cataract surgery, Baltussen et al (2004) used varying proportions of coverage (50%, 80% and 95%) and a 3% discount rate to find globally that intra- and extra-capsular cataract surgeries are cost effective. They found that providing extra-capsular cataract surgery to 95% of those who need worldwide would avert over 3.5 million DALYs per annum. Table 3.1 below summarises the cost effectiveness by region.

Table 3.1: Cost effectiveness ratios of surgery for cataracts ($I*/DALY)

World Health Organization region	ICCE			ECCE		
	50%	80%	95%	50%	80%	95%
America[11]	-	-	-	860	726	776
Region of the Americas – A[12]	350	261	254	188	139	135
Region of the Americas – B[13]	312	264	269	166	139	141
European Region – A[14]	NA	NA	NA	1,693	1,297	1,328
European Region – B[15]	NA	NA	NA	465	373	393
European Region – C[16]	345	295	295	184	156	155
Western Pacific Region[17]	NA	NA	NA	3,090	2,373	2,307
Western Pacific Region[18]	282	221	215	157	123	119

Source: Baltussen et al (2004). NA = not applicable.

*$I= International dollars equivalent to US$

More recently and broadly aligning with Baltussen et al (2004) findings, Lansingh (2006) found that cost utility values for cataract surgery (first eye) varied from $245 to $22,000/QALY in Western countries and from $9 to $1,600 in developing countries. In developed countries, the cost effectiveness of cataract surgery ranged from, in international dollars (I$), I$730 to I$2,400/DALY averted, and I$90 to I$370/DALY averted in developing countries.

3.2 Comparison with other interventions

Lansingh et al (2006) also undertook a review of literature from 1995 onwards to determine how cost effective cataract surgery is compared to five other medical interventions that were

[11] Includes Canada, United States, Cuba and more.

[12] Includes Antigua and Barbuda, Argentina, Bahamas and more.

[13] Includes Bolivia, Ecuador, Peru and more.

[14] Includes Austria, Belgium, Croatia, United Kingdom and more.

[15] Includes Poland, Romania, Turkey, Yugoslavia and more.

[16] Includes Russian Federation, Ukraine, Estonia and more.

[17] Includes Australia, Japan, New Zealand, Singapore and more.

[18] Includes Cambodia, China, Malaysia, Papua New Guinea, Vietnam and more.

'closely matched' (i.e. involved surgery, were age-related, and were not performed under life threatening conditions). The five comparators were epileptic surgery, surgery for carpal tunnel syndrome, hip arthroplasty, knee arthroplasty and defibrillator implantation.

The cost utility of other comparable medical interventions was:

- epileptic surgery, $4,000 to $67,000/QALY;
- hip arthroplasty, $2,300 to $4,800/QALY;
- knee arthroplasty, $6,500 to $14,600/QALY;
- carpal tunnel surgery, $140 to $280/QALY; and
- defibrillator implantation, $700 to $23,000/QALY.

Table 3.2 below summarises the cost utility of the selected medical interventions. The results indicate that cataract surgery, ranging from $245 to $22,000/QALY in the Western world (Lansingh et al, 2006) is generally more cost effective than either epileptic surgery or defibrillator implantation, and with a substantially more cost effective lower bound than knee arthroplasty.

Table 3.2: Cost utility of Selected Medical Interventions

Intervention	Cost utility (US$/QALY)	Country	Reference
Carpal tunnel syndrome	140	United States	Chung et al
	282		
Epileptic surgery	18,331	United States	Langfitt
	32,000	United States	King et al
	67,026	Switzerland	Tureczek et al
	3,983	Colombia	
Hip arthroplasty	2,279	Canada	Rorabeck et al
	2,276	Finland	Rissanen et al
	2,400	United Kingdom	Keating et al
	2,531	United States	Cheng et al
	4,824		
	4,474	United States	Bozic et al
Knee arthroplasty	12,720	Finland	Rissanen et al
	10,618	Australia	Burns et al
	6,535	Canada	
	8,513	United Kingdom	
	6,701	New Zealand	
	10,325	Sweden	
	14,603	United States	
Implantable defibrillator	7,050	Senegal	Thiam et al
	704		
	22,623	United States	Sanders et al
	21,804	United States	Chan et al

Source: Lansingh et al (2006).

4 Developments in cataract treatment

Over the last decade, there have been major advances in cataract surgery including advances in anaesthesia for cataract surgery, new incision techniques, new phacoemulsification technologies, IOL material design and management of cataract surgery complications.

Newer anaesthesia techniques

There are varying anaesthetic techniques and anaesthetic agents in cataract surgery. In the past decade, the most important development in anaesthesia for cataract surgery is the introduction of topical anaesthesia. Topical anesthesia involves the application of eye drops, sponge anesthesia or application of gel. The most attractive aspect of this topical anaesthesia is its simplicity, avoiding the need for injections (Bhopi, 2004). Topical anaesthetic cataract surgery has also been shown to abolish the risk of complications such as degeneration of muscle fibres after cataract surgery as well as improving problems with the alignment of the eyes (Chung, 2009).

New (smaller) incision techniques

There has been progressive decrease in size of the cataract incision along with newer cataract surgical techniques. The size of wound has progressively decreased from 12.0 mm in intra-capsular cataract surgery to 10.5 mm in early extra capsular surgery to 5.25 mm with the advent of phacoemulsification. Foldable IOLs have further reduced the size of incision to 3.0 mm or smaller. Advantages of smaller sized incisions include reduced trauma for the person undertaking the surgery, faster healing and reduced risk of complications (Bhopi, 2004).

New phacoemulsification technologies

Since phacoemulsification began in 1967, there have been numerous technological improvements. The last ten years in particular have seen significant developments, with newer phacoemulsification systems designed to deliver less traumatic surgery, lower related hospitalisation costs and early visual rehabilitation. This has included techniques such as using sound waves or sonic pulses of 40 to 400 Hz to perform phacoemulsification (Bhopi, 2004). These techniques reduce the heat and energy associated with performing cataract surgery, which is better for the patient, as well as allowing the ophthalmologist to operate more efficiently.

Recent advances in IOL material and design

Sir Harold Ridley, in 1949, first introduced IOLs constructed from polymethyl methacrylate (PMMA). The extensive use of PMMA since its development has meant that the lens is considered reliable and relatively safe given the success of cataract surgery worldwide. IOL material and design however, has evolved and improved in line with cataract surgery. Major improvements to IOLs include:

- monofocal IOLs that are now foldable, providing faster recovery time as well as aspheric lenses that reduce high order aberrations to improve night driving; and
- toric IOLs that have been developed to correct astigmatism in people undergoing cataract surgery. Studies (Xiao-Yi Sun et al, 1998) have shown that toric lenses reduce and eliminate corneal astigmatism decreasing the need for glasses or contact lenses (but do not correct for presbyopia as multifocals can).

5 Comparing current versus novel cataract treatment

This section compares the cost effectiveness of current cataract treatment with a novel treatment protocol for cataract.

The cost effectiveness analysis (CEA) requires data on the treatment costs as well as benefits arising from treatment, in terms of dollars and wellbeing.

- Wellbeing can be measured in QALYs or DALYs and an incremental cost effectiveness ratio (ICER) can be used to estimate the value of the novel therapy relative to standard treatment (e.g. in $/DALY averted).
- The ICER can be compared to various benchmarks such as the World Health Organization benchmark of 'very cost effective' being equivalent to costing less than GDP per capita per DALY. A 'cost saving' intervention both saves dollars and provides more wellbeing.
- The comparison between standard and novel treatment in this report is evaluated using CEA rather than cost benefit analysis (which compares dollars spent with dollars gained, and can cover broader aspects of benefits such as productivity savings). While DALY savings could be converted to dollars using the value of a statistical life year (VSLY), CEA is generally used to evaluate interventions when the *main* benefits are gains in wellbeing (i.e. lifespan and health-related quality of life). This is elaborated further in the discussion of general methodological issues below.

5.1 General methodological issues

5.1.1 Valuing life and health

Over the last two decades, a non-financial approach to valuing human life has been derived, where loss of wellbeing and premature mortality – called the 'burden of disease and injury' – is measured in DALYs. This approach was developed by the World Health Organization (WHO), the World Bank and Harvard University for a study that provided a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990, projected to 2020 (Murray and Lopez, 1996). Methods and data sources are detailed further in Murray et al (2001) and the WHO continues to revisit the estimates for later years.

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

Note that a DALY is the reverse of a QALY, where 1 represents perfect health and 0 represents a health state perceived equivalent to death. Moreover, the disability weights for health impacts for DALYs are determined externally (by a panel of experts on the basis of literature and other evidence of the quality of life in relative health states), while QALYs are generally based on metrics that place greater emphasis on the individual's perceived utility from their own different health states and thus may vary more across individuals.

The DALY approach has been adopted and applied in Australia. Mathers et al (1999) from the AIHW estimated the burden of disease and injury in Australia in 1996, while Begg et al (2007) revisited the Australian estimates for the year 2003. The AIHW values DALYs equally for Australians of all ages, genders and ethnicities. 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 across nations.

The main problem (which is also a strength) with these approaches is that they are not financial and thus not directly comparable with most other cost and benefit measures. In public policy making, therefore, there is often the desire to apply a dollar conversion to ascertain the cost of an injury, disease or fatality or the value of a preventive health intervention, for example in cost benefit analysis. Such financial conversions tend to utilise willingness to pay valuations as described in the next section.

An alternative approach in decision-making is to develop implicit or explicit benchmarks whereby an intervention is considered to be cost effective. A particular type of CEA is cost utility analysis, where the metric is ‘dollars per DALY averted’ or ‘dollars per QALY gained’. Access Economics (2008) shows that such benchmarks for public financing purposes tend to be lower in the Australian health and transport sectors than the estimated average value of a statistical life year (VSLY), which is in the interests of fiscal restraint.

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

The burden of disease as measured in QALYs gained or DALYs averted can be converted into a dollar figure using an estimate of the value of a ‘statistical’ life (VSL). As the name suggests, the VSL is an estimate of the value society places on an anonymous life. Since Schelling’s (1968) discussion of the economics of life saving, the economic literature has focused on willingness to pay – or, conversely, willingness to accept – measures of mortality and morbidity, in order to develop estimates of the VSL.

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

The extensive literature in this field mostly uses econometric analysis to value mortality risk and the ‘hedonic wage’ by estimating compensating differentials for on-the-job risk exposure in labour markets; in other words, determining what dollar amount would be accepted by an individual to induce him/her to increase the probability of death or morbidity by a particular percentage.

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

As DALYs are enumerated in years of life rather than in whole lives it is necessary to calculate the Value of a 'Statistical' Life Year (VSLY) based on the VSL. The formula is derived from the definition:

VSL = ΣVSLYi/(1+r)^i where i=0,1,2….n

where VSLY is assumed to be constant (i.e., no variation with age).

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

The Office of Best Practice Regulation (OBPR) has provided an estimate of the VSLY in Australia, which appears to represent a fixed estimate of the net VSLY. The OBPR (2008) states that the VSLY is $151,000 in 2007 dollars. The OBPR further advises that for use in 2009 this figure should be inflated to $161,750 in 2009 dollars – which assumes that the annual consumer price index was 4% for 2008 and 3% for 2009 ($151,000 * 1.04 * 1.03).

5.1.3 Incremental cost effectiveness and benchmarks

ICERs are calculated for standard versus novel cataract treatment in terms of net dollars per QALY gained or net dollars per DALY averted.

- If the intervention saves costs and gains more QALYs (or averts more DALYs) relative to its comparator, it is described as **dominating** (and its comparator is **dominated**).
- If an intervention is more expensive than its comparator but gains more QALYs (or averts more DALYs), cost effectiveness benchmarks or other tools are needed to decide whether or not to pursue the intervention.
- If an intervention is less expensive but gains fewer QALYs (or averts fewer DALYs), benchmarks or tools are also required, but change is often sticky in this direction.

As outlined in Section 3, CEA may use a variety of benchmarks. These can be further developed to include:

- GDP per capita i.e. around $50,000 in 2009 – in line with the WHO guidelines for being 'very cost effective' (recall Section 3.1);
- $60,000 – in line with the Department of Health and Ageing - DoHA (2003); or
- the VSLY of $161,750 in 2009 dollars – in line with the OBPR's recommendations outlined in Section 5.1.2 above.

5.1.4 Markov models and decision trees

While it is rather complex, Markov CEA analysis is a well-established and rigorous method of demonstrating the value of interventions. Markov chains (named after Andrey Markov) model a discrete-time stochastic process with the Markov property, namely that – given the present state – the future is conditionally independent of the past.

At each instant in time, the system may change its state from the current state to another state, or remain in the same state, according to a certain probability distribution. The changes of state are called transitions, and the probabilities associated with various state-changes are termed 'transition probabilities'.

5.1.5 Discount rates

A discount rate is used to convert streams of benefits or costs into today's dollars. Choosing an appropriate discount rate for present valuations in cost analysis is a subject of some debate, and can vary depending on what type of future income or cost stream is being considered. For the modelling undertaken here, two important streams need to be discounted: financial costs (e.g. glasses costs) and quality of life. A real discount rate of 3% is used. Access Economics (2008) provides a more detailed description of discount rates used in CEAs and cost benefit analyses where valuing streams of healthy life are involved.

5.2 Comparing treatment pathways

The surgical pathway for cataract treatment was prepared in consultation with a clinical reference group. The reference group was important in estimating and triangulating costs and protocols for standard compared to novel treatment.

The most commonly preferred method of cataract surgery is phacoemulsification where an IOL is implanted into the eye (see discussion at Section 2.5).

The types of lenses for cataract treatment broadly include:

- lenses that address a single fixed focal point (monofocal lenses), which are suitable either for reading or for distance vision;
- lenses that address multifocal points (i.e. can focus at different points for both reading and distance vision); and
- lenses that will also correct astigmatism.

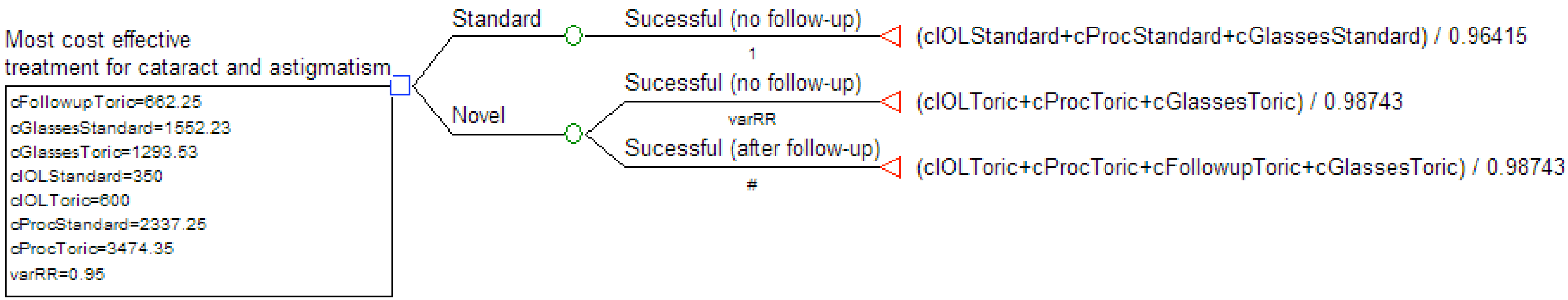
Research, and consultation with the reference group, indicated that most 'standard' surgeries involve monofocal lenses. While a potential comparator for the 'novel' treatment arm was the use of multifocal lenses, this pathway is quite complex to model due to issues such as reduced visual contrast, glare and halos. As such, toric lenses were considered for the novel pathway. It would be useful to conduct a CEA of multifocal lenses as a separate exercise.

Most people who have cataract also have either corneal astigmatism or lenticular astigmatism. The prevalence of people with cataract and astigmatism account for 20% of all people with at least mild cataract (see Section 2.5). Toric lenses are used to correct for cataract and astigmatism. They are a relatively recent or novel development in cataract treatment over and above standard lenses which only remedy the cataract.

> As a result the analysis defines the 'standard' treatment as the procedure using monofocal lenses only with the 'novel 'treatment defined as cataract surgery with toric IOLs. Both standard and novel treatments make use of phacoemulsification.

The standard and novel cataract treatments are evaluated using a decision tree to determine the differences in ICERs. The pathways are summarised in the TreeAge diagram in Figure 5.1.

Figure 5.1: Cataract treatment comparison



Source: Access Economics (2009).

Descriptions of variables in the decision tree include:
cFollowupToric = cost of follow up adjustment of a toric lens;
cGlassesStandard = net present value (NPV) of the cost of glasses that correct for vision impairment after cataract surgery (astigmatism remains);
cGlassesToric = net present value (NPV) of the cost of glasses that correct for vision impairment after cataract surgery (no astigmatism);
cIOLStandard = the cost of a standard IOL;
CIOLToric = the cost of a toric IOL;
cProcStandard = the cost of a standard cataract treatment procedure;
cProcToric = the cost of a novel cataract treatment procedure;
varRR = the probability that a novel treatment will be successful on the first attempt

The model follows a decision tree rather than a multiple stage Markov chain as events occur within a single time interval, given that the cataract procedure and its effects are almost immediate and there is generally a short period elapsed between diagnosing the need for cataract surgery and carrying out the surgery itself. The parameters in the CEA were modelled using TreeAge Pro.

- The 'standard' treatment protocol involves an ultimately 'successful' cataract surgery, which is consistent with the effectiveness of cataract surgery literature discussed above at Section 2.6). The QALYs gained reflect all outcomes (some more successful than others).
- The 'novel' treatment protocol also involves an ultimately successful cataract surgery using toric lenses. However, consistent with discussions with the reference group, in 5% of cases a follow up surgery is required to realign the lens before being 'successful' (as again reflected in QALYs gained).

Derivation of the model inputs and parameters are provided in the next section.

5.3 Model inputs and parameters

The following inputs and parameters are based on the cost of performing surgery on one eye only. This provides a more conservative estimate of the costs and is reasonable given that people may have cataract in one eye only when undertaking the surgery.

5.3.1 The cost of standard treatment

The standard treatment protocol involves a procedure cost, IOL cost and the cost of glasses required after treatment. While there may be other costs, these three were included as the elements that would be likely to differ in relation to novel treatment, on the basis of advice from the reference group.

5.3.1.1 Standard procedure cost

The cost of a standard cataract treatment procedure (labeled as cProcStandard in the decision tree at Figure 5.1) has been calculated by considering the public and privately funded components of cataract surgery.

The September 2009 Medicare Benefits Schedule (MBS) approves a fee of $831.60 for lens extraction and insertion of an artificial lens (item 42702). However, the recommended Australian Medical Association (AMA) fee as at November 2008 for this procedure (item number MC492) is almost four times greater at $3,160.00.

Also included in the standard treatment costs is an examination by an ophthalmologist proxied by the MBS item number 106 costing $65.65. The AMA recommended fee for the same item (number AC540) is $220.00.

The weighted public and private cost is estimated by applying the proportion of bulk-billed services for operations (42%) sourced from Medicare statistics.[19] The result is a combined total for the cost of standard cataract of $2,337.25 per eye (calculated as [($831.60+$65.65)*42%] plus [($3,160.00+$220.00)*58%].

[19] Department of Health and Ageing (2009) Medicare Statistics - June Quarter 2009, http://www.health.gov.au/internet/main/publishing.nsf/Content/medstat-jun09-tables-ba.

5.3.1.2 Standard IOL cost

The cost of a standard monofocal lens prosthesis (labeled as cIOLStandard in the decision tree at Figure 5.1) is assumed to be $350. This was based on consultations with Alcon and the reference group, which indicated that monofocal IOLs cost between $300-$400, and taking the mid point of this cost estimate.

5.3.1.3 Glasses cost after standard cataract surgery

Glasses generally need to be worn after standard cataract surgery to correct for conditions such as presbyopia (where the eye has a diminished ability to focus on near objects) as well as for astigmatism (see Section 4).

The standard cost of a pair of glasses (labeled as cGlassesStandard in the decision tree at Figure 5.1) was estimated to be $300 based on data from glassesonline.com.au[20]. It was further assumed that a pair of glasses lasts for three years.

The lifetime costs of glasses were included by applying the life expectancy for people aged 55 or over, sourced from the ABS Life Tables, Australia, 2005–2007 (ABS, 2008) to the prevalence of cataract. Ages 55 and over were selected because cataract is most prevalent in this age cohort, and data were available for various required input parameters for this age group.

ABS data indicate that males aged 55 are likely to live for another 27.0 years and females aged 55 for a further 30.5 years. According to AIHW (2005) males represent 41.4% of the cataract population and females 58.6%. This means the average life expectancy for people aged 55 is another 29.1 years – calculated as (27.0*41.4%) plus (30.5*58.6%).

This means that people with cataract are likely to require around 9.7 pairs of glasses over their lifetime (29.1 years divided by the three year life of a pair of glasses).

This equates to a cost of $2905.01 ($300*9.7). Discounting this by 3% per annum (as per Section 5.1.5) over 29.1 years provides a net present value (NPV) lifetime cost of $1,552.23 for standard glasses.

> As a result, the total cost of a standard treatment of cataract is estimated at $4,239.48 per eye ($2,337.25+$350+1552.23).

5.3.2 The cost of novel treatment

The novel treatment protocol involves a procedure cost, IOL cost for a toric lens and the cost of glasses required after treatment, since these costs are likely to differ from those in the standard treatment pathway.

5.3.2.1 Novel procedure cost

The cost of a novel cataract treatment procedure involving a toric IOL (labeled as cProcToric in the decision tree at Figure 5.1) has been calculated by combining the public and privately funded components of cataract surgery.

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[20] http://www.glassesonline.com.au/cheap-spectacles-online-discount-spectacles.htm, accessed on 9 September 2009. Some patients may be able to function adequately with $20 readers (pers. comm. Rieck Dalal, Alcon Surgical division, 21/09/09).

Based on consultations with the reference group, there has been an inclusion of additional ophthalmologist time (an additional 5-10 minutes) and additional use of capital equipment (an extra 15% usage) to reflect the added complexity of the novel treatment protocol. Overall this is estimated to add a further 48.65% to the costs of the standard treatment procedure.

Given that the cost of standard cataract treatment is estimated at $2,337.25 per eye this means the procedure cost of novel or toric treatment is $3,474.35 per eye.

5.3.2.2 Novel procedure follow-up cost

According to consultations with the reference group, in 5% of novel treatment cases a follow up surgery is required to ensure the toric lens is properly aligned.

The cost of this follow-up procedure (labeled as cFollowupToric in the decision tree at Figure 5.1) was estimated by combining the MBS item 42704 fee for removal of repositioning of a lens costing $430.60 with the reciprocal AMA recommended fee of $830.00 (item number MC500).

The weighted cost is again estimated by applying the bulk-billing percentage for operations sourced from Medicare statistics,[21] resulting in a combined total of $662.25 per eye (calculated as ($430.60)*42% plus ($830)*58%.

5.3.2.3 Novel IOL cost

The cost of a novel toric lens prosthesis (labeled as cIOLToric in the decision tree at Figure 5.1) is assumed to be $600. This followed consultations with Alcon and the reference group, which indicated that toric IOLs cost between $500-$700, and taking the mid point of this cost.

5.3.2.4 Glasses cost after novel cataract surgery

With novel treatment for cataract, glasses being worn after the cataract surgery will only need to correct for presbyopia and not for astigmatism. This will generate some lifetime savings on the costs of glasses for people undertaking novel cataract treatment.

The novel cost of a pair of glasses (labeled as cGlassesToric in the decision tree at Figure 5.1) was estimated to be $250 based on data from glassesonline.com.au[22] (slightly cheaper than standard glasses as these do not need to correct for astigmatism). It was again assumed that a pair of glasses lasts for three years. And the lifetime costs of glasses were included by again applying the life expectancy for people aged 55 or over to the prevalence of cataract. As with the standard pathway, the average life expectancy for people aged 55 is another 29.1 years, so people with cataract are likely to require around 9.7 pairs of glasses over their lifetime.

This equates to a cost of $2,420.84 ($250*9.7). Discounting this by 3% per annum (as per Section 5.1.5) over 29.1 years provides a net present value (NPV) lifetime cost of $1,293.53 for standard glasses.

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[21] Department of Health and Ageing (2009) Medicare Statistics - June Quarter 2009, http://www.health.gov.au/internet/main/publishing.nsf/Content/medstat-jun09-tables-ba.

[22] Source: http://www.glassesonline.com.au/cheap-spectacles-online-discount-spectacles.htm, accessed on 9 September 2009.

> Overall, the total cost of a novel treatment for cataract is estimated at $5,401.00 per eye ($3,474.35+5%*662.25+600+1293.53).

5.3.3 The quality of life effects from standard and novel treatment

As outlined in Section 2.6, cataract surgery is highly effective. As a result, following cataract treatment, people can expect to lead a relatively full quality of life with reduced vision loss. However, there may be some side effects which would slightly affect the quality of life and some vision loss will persist. With developments in cataract surgery (such as those under the novel or toric treatment protocol) the quality of life after treatment can be increased even further.

The AIHW (2003) provides estimates for how much cataract impacts on an individual's quality of life. Cataract with mild vision loss is attributed a 0.02 disability weight, cataract with moderate vision loss attracts a 0.17 disability weight, and cataract with severe vision loss is associated with a 0.43 disability weight.

Applying the inverse of the AIHW approach, mild cataract is associated with 0.98 quality of life (1 minus 0.02) and similarly moderate and severe cataract have a quality of life impacts of 0.83 and 0.57 respectively.

From the New Zealand data in Table 2.3, pre-cataract surgery quality of life is estimated as a weighted average of [47%*(0.02+0.17)/2]+[24%*0.43] =0.14785 or a QALY score of 0.85215 (TreeAge uses QALYs rather than DALYs).

Three studies provided estimates of the improvement in vision with comorbid stigmatism or other eye conditions (recall Section 2.6). Xiao-Yi Sun et al (1998) found that in toric IOL patients, 84% of eyes had that visual impairment corrected (to better than 6/12) whereas in the spherical IOL group (non-toric) only 76% corrected visual impairment. In the UK the final improvements were 92% and 77% respectively while in Australia the improvements were 95% and 'less than 80%' (assumed around 75%) respectively. A weighted average of these improvements was used to model the relative improvement in acuity, with double the weight given to the Australian data relative to the overseas data, for the standard and novel paths.

Overall, the average full sight restoration was found to be 91.5% and 75.8% respectively, so the QALY outcome associated with:

- novel treatment was 91.5%*1+8.5%*0.85215 =0.98743; and with
- standard treatment was 75.8%*1+24.3%*0.85215 =0.96415.

5.4 Results

The model input costs and parameters for standard and novel cataract treatment are then compared using TreeAge according to the decision tree outlined at Figure 5.1.

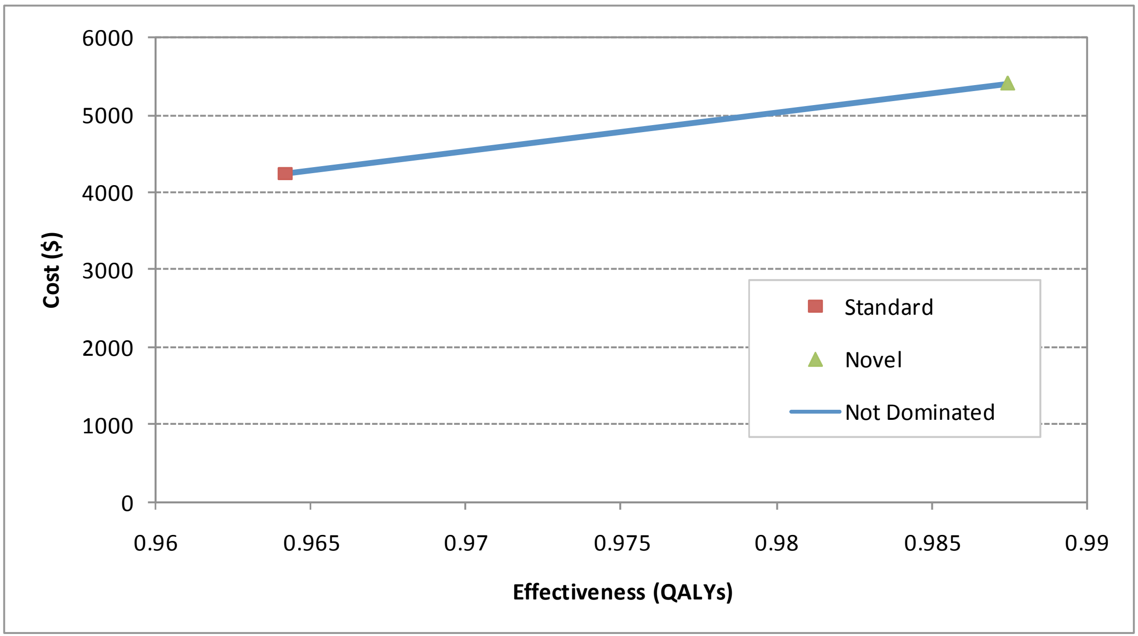
The results from the TreeAge model indicate that standard cataract treatment is cheaper but less effective (in terms of QALYs) compared to the novel treatment protocol.

When cost and effectiveness are plotted against each other, there is a pathway of treatment connecting standard and novel cataract treatment – rising from cheaper but less effective standard treatment to more expensive but more effective novel treatment.

The cost effectiveness (CE) of standard treatment is $4,397 whereas the CE of novel treatment is a relatively close $5,470. The results indicate that no strategy was clearly dominated by the other. As a result other benchmarks of incremental cost effectiveness, such as the ICER, need to be applied.

> The ICER of novel treatment is $49,890/QALY and as such it proves to be a cost effective intervention by all three criteria.
>
> This result is under the ICER benchmarks outlined in Section 5.1.3 and makes toric lenses a sensible option for the treatment of cataract.

Chart 5.1: Cost versus effectiveness



Source: Access Economics.

6 Conclusions and recommendations

Australia's population is ageing. This will mean an increase in chronic conditions that include sensory disorders such as visual impairment resulting from cataract.

- Previous research by Access Economics indicates that demographic ageing over the coming decades will result in those blind from cataract increasing to 10,707 by 2024, and those with visual impairment from cataract rising to 118,750 people, if there are no changes to treatment and prevention.
- Similarly, the AIHW (2008) projects that health and ageing expenditure on sense disorders (of which visual impairment and cataract are a part) will increase from $2.6 billion in 2002-03 to $8.8 billion in 2032-33. This is an increase of 236% and represents one of the top three leading causes of projected growth in all areas of health and aged care expenditure (along with diabetes and neurological disorders such as dementia).

> These challenges highlight the need for new approaches to prevent and treat cataract, including how best to finance this treatment.

In terms of treatment, the available evidence suggests that cataract surgery is a highly effective as well as a cost effective way of correcting visual impairment and other impacts from cataract.

- With recent developments in cataract surgery (such as those using toric lenses to treat cataract as well as astigmatism) the quality of life after treatment can be increased even further, although the primary benefit remains from the removal of the cataract.
- Novel developments in cataract treatment (represented in this analysis by the use of toric lenses) are also a more cost effective way of treating cataract compared to established or standard treatment protocols, so patients are better off – but in Australia at present (unlike overseas) there is generally no impact on service payments reflecting this gain.

According to the Australian Society of Ophthalmologists, 70% of the cataract operations performed in Australia are currently being undertaken in the private system, and 30% in the public system.[23] The Society further states that provision of public hospital cataract services in rural, remote and indigenous areas is funded solely by public funds as surgeons bulk-bill or use other no-gap arrangements.

> Given the cost effectiveness of current and novel cataract treatment, there is a strong argument for continued public funding support – including through MBS subsidies. In particular, the cost effectiveness of toric lenses that remedy astigmatism as well as the benefits of multifocal lenses that address presbyopia provide an argument for MBS funding through a specific item number for these novel services. Another option might be to allow public patients to be able to access novel IOLs by paying a gap in public hospitals.

[23] See Australian Society of Ophthalmologists Submission to the Inquiry into Health Insurance Amendment: http://www.aph.gov.au/SENATE/COMMITTEE/CLAC_CTTE/health_insur_extend_medicare_safety_net_09/submissions/sub06.pdf.

However, the opposite trend appears to be occurring. The Australian Government stated in the recent 2009-10 Budget that it will reduce that the Medicare reimbursement for cataract surgery as of November 2009 from $831.60 to $409.60 or by around 50%. In addition, the Australian Government announced caps on cataract surgery under the Extended Medicare Safety Net. These caps are scheduled to take effect from 1 January 2010.

- The justification for these reforms was ostensibly because cataract procedures can now be performed more quickly[24] and safely due to improvements in technology. Further, the caps to the Extended Medicare Safety Net were rationalised as a way of reprioritising this program to ensure people with prolonged health care needs have access to it and that only some assistance is provided for those with one-off high health care costs (Federal Government, 2009-10 Budget).
- However, another motive for the Government may (speculatively) have been to cut or reprioritise long term transfer-type spending in a very tight fiscal environment, providing more availability of funds to investment-type stimulus measures.
- For jurisdictions with dispersed populations (e.g. Queensland and Western Australia), rebate reductions may reduce ophthalmologist visits to regional centres requiring instead patient travel to services. Transport costs are borne in part by state health departments but there are also out-of-pocket and time costs for the patient.

As discussed in previous chapters, cataract treatment in Australia has been improving health outcomes over time (with safety improvements evident in the bring-forward of the intervention time), as new technologies and techniques are introduced – however, these new protocols are not less costly necessarily. Keeping pace with innovation may require a higher and more refined skill set and continuous upgradation of surgeon skills, as well as capital costs (e.g. replacement and maintenance of equipment geared specifically to new technologies). At the same time, Medicare rebates have been reduced dramatically.

The MBS fee for Item 42702 was cut sharply in real terms previously – by 32% in 1987 and 10% in 1996. Current proposed changes would halve the fee. Moreover, given that MBS indexation imposes real cuts to claw back productivity gain, real costs have been cut 80% for item 42702 in the past two decades (based on unpublished Access Economics analysis of MBS data). There is no evidence to suggest that the operation time has been cut to 20% of the time taken in 1987 and, even if so, operation time is only part of the story. The fee for the item covers an average of 2.81 post-operative care consultations as well as the cost of the lens.[25]

The 2009-10 Budget changes are likely to have a significant impact on areas where there is more reliance on public finding (e.g. rural and remote regions as well as indigenous areas). It also means that people with cataract will have to foot even more of the bill for surgery – even though the procedure is cost effective. Those that can no longer afford to pay to access

[24] A 2009 survey at the Queensland Eye Hospital, the largest ophthalmic day facility in Australia (with 41 surgeons and around 4,000 cataract surgeries per year) used official timing criteria and electronic time in motion software to estimate and verify the average the average length of cataract surgery as 28 minutes (pers. comm. Horsburgh 21/9/09).

[25] The MBS rebate for an initial consultation is $67 and for a subsequent consultation is $34. However, a survey of 37 individual practices in the 12 months to August 2009, representing more than 120,000 patient consultations and inpatient surgical procedures, estimated the average overhead in private ophthalmic practice as $113 per patient encounter (range $77- $147, standard deviation $17), well above the rebate (pers. comm. Horsburgh 21/9/09).

cataract surgery at an appropriate stage will wait in public hospital queues, with the associated high economic and social costs – loss of productivity, quality of life and the burden on carers due to loss of independence (inability to read, drive, cook, and so on). To the extent that surgeries are transferred into the public hospital sector, the Budget changes represent cost-shifting from the Australian Government to the state and territory health services.

With the rapid increases in cataract surgeries that are projected to be required over coming decades, the financing mechanism must simultaneously meet objectives of efficiency, equity and sustainability. There are five options the Australian Government has to reduce this expected budgetary pressure, including:

- higher taxation (debt is not a long term option);
- rationing of publicly funded cataract treatment;
- increased efficiency in providing cataract treatment;
- greater funding participation from the private sources; or
- a combination of the above.

Higher taxation will be feasible only if society is willing to pay more for health care through this means. Increasing taxes comes with its own set of problems and deadweight inefficiency losses. Further, rationing is politically challenging, unlikely to be socially optimal, and unlikely to be sustainable in the long term. Increased efficiency in cataract treatment (such as can still be realised, noting it is already very efficient) and greater funding participation from private sources seem to play the most important part as options.

It may thus become increasingly important for people with capacity to pay (through high incomes or accumulated wealth) to cover more of their own cataract surgery costs, allowing the government to continue providing safety nets for those without the financial means. To increase greater funding participation from private sources (e.g. self-funded by people with cataract), capacity to pay must also be increased. Individuals could use their superannuation funds to purchase medical services, but moral hazard prevents this from occurring in general. The moral hazard is derived from both the zero marginal cost of accessing public health services – even for those with the capacity to pay – together with the incentive to spend superannuation (in the many years between retirement and when a cataract surgery may be required) on items such as travel or other leisure activities.

Consequently, at present there is little scope for consumers to choose to supplement Medicare rebate funding by providing out-of-pocket payments for extra service options. This is true across a broad spectrum of health, aged care and other social services.

One option to remedy this problem, better meet upcoming financing needs, and to improve consumer choice is to introduce dedicated savings accounts for health care expenditure which could also cover cataract treatment. These types of funding vehicles are generally known as health ageing savings accounts (HASAs). The creation of HASAs could build on the success of superannuation to specifically provide for the more predictable financing needs of healthy ageing (hospital services, day surgery services, residential and community aged care services), as well as out of pocket expenses, deductibles, preventive health and other approved items.

Individuals with capacity to pay could contribute income to the account throughout their life at a reduced tax rate to encourage savings. Funds could be restricted by the government to expenditure on items associated with health care needs and aged care needs. The introduction of HASAs could provide an incentive for individuals to save for their more predictable health and aged care needs.

- HASAs would increase the capacity to pay for future healthcare needs as well as providing people choice in terms of where they seek to receive treatment. HASAs may also help improve the quality of outcomes as individuals seek out better medical professionals and novel treatment pathways.

Reform of health financing is overdue and, as the National Health and Hospital Reform Commission has recommended, there is a strong case for maintaining a mixed public-private financing system. This requires cultivating strong private sector involvement and adopting appropriate financing vehicles. For provisioning that is highly likely as cataract is, insurance (for catastrophic events) is less relevant than savings products.

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