

**APPENDIX C.1 CATARACT SURGERY
LITERATURE REVIEW**

Western Canada Waiting List Project

Literature Review – Cataract Extraction

By

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1. Introduction

This literature review summarizes recent study-based data concerning the outcomes of cataract surgery. This review was conducted under the auspices of the Western Canada Waiting List Project for use by the cataract surgery panelists while developing priority criteria and associated criteria weights. Panelists will be asked to assess the extent to which the review provided meaningful assistance in this regard.

The information contained in this report will also be used to help develop a method for comparing the severity of patients' suffering and disability across different domains, e.g., poor vision due to cataracts versus pain and stiffness due to hip arthritis. (This process is separate and distinct from the cataract panel's mandate, which is to develop criteria specifically for cataract patients.) It is for this reason that pre-operative severity is described at rather more length than usual and why standardised scaling formats are used for summarizing the results depicted by study questionnaires.

This report focuses on three major questions: (1) severity of suffering and disability pre-operatively, (2) the degree to which cataract surgery alleviated suffering and disability and (3) which pre-operative indicators were indicative or predictive of the degree of benefit experienced by patients following cataract surgery. These are the issues most directly relevant to the task of developing criteria and for purposes of cross-treatment comparisons.

2. Search Strategy

The PubMed search service was used to search the Medline database, a system maintained by the National Library of medicine (NLM). The searches were limited to articles published between 1989 and 1999, either written in English or that had an English abstract. Articles retrieved are the result of a search combining 46 medical search headings (MeSH) within the service topic "cataract extraction" (Appendix A). Additional searches were conducted by specific tests (eg Visual Function-14) and by concept (eg functional impairment).

Records returned from these primary searches were screened by a Medical Librarian Specialist to eliminate any items that were not likely to have relevant information (referred to as the "false drop filter"). Abstracts for 282 remaining articles were then reviewed, and added to a custom reference database. If an abstract pertained to any of the research questions, the article was fully reviewed, and an ACT was completed.

A secondary search was also conducted from the articles on hand; once obtained, the articles were added to the reference database, reviewed, and the search terms modified as indicated. Articles were considered with respect to the three research questions listed in the Introduction. Data from sixty articles was recorded on the "Article Coding Template" or ACT (Appendix B). This information was then used to create a database that also holds all reference information, as well as other data used for this report.

3. Condition and Treatment Description

A cataract is a painless ocular lens opacity associated with varying levels of visual acuity loss and reduced function. Most cataracts occur in the elderly, and they are especially prevalent in those aged 75 or older.

Individuals with cataracts seek medical intervention for complaints of blurred or foggy vision, problems with low light or night vision, difficulty seeing because of glare, or double vision. Clinical findings can include decreased visual acuity (commonly asymmetrical), direct visualization with ophthalmoscope and/or slit-lamp examination after pupillary dilation, and to a lesser degree, the measurement of glare or contrast sensitivity, particularly for patients suspected of having an early cataract.[1-3]

According to the 1993 Cataract Management Guideline Panel sponsored by the Agency for Health Care Policy and Research (AHCPR), the goal of cataract treatment (surgical or non-surgical) is to maintain or restore autonomy by removing or reducing visual disability.[4]

Non-surgical treatment consists of the use of eyeglasses, including strong bifocals, or the use of vision aids like a magnifying glass. Surgical treatment is usually elective and entails the removal and/or replacement of the cloudy lens, using one of several techniques including phacoemulsification and extracapsular cataract extraction. As the data will show, most patients' vision, function, and quality of life improve following cataract extraction.

The AHCPR Guideline [4] states that cataract extraction is indicated for patients with 20/50 visual acuity or worse who experience disability as a result of their vision loss. People experiencing 20/40 visual acuity or better must also have documented visual impairment, such as inability to drive, significant visual disparity between eyes, or monocular diplopia, or problems with glare, before they are considered appropriate for surgery. In other words, regardless of the visual acuity, if a cataract causes functional impairment considered by the patient to be problematic enough to risk surgery (and the impairment is documented), cataract removal is indicated. Contrariwise, if patients have adequate visual function, visual acuity is considered of relatively little significance.

Vision-related function can be described in many different ways, as demonstrated by the large number of tools and scales developed to measure visual function (Appendix D). For example, functional impairment can be described as an inability (or reduced ability) to perform activities such as driving, reading (especially fine print), doing handiwork, participating in hobbies, socializing with friends or family, or working.

Experiencing blurred vision more than once or twice a month has a detectable and significant impact on functional status and well-being. In one study on preferences for health states, patients rated the impact of blurred vision as significantly greater than the impact of hypertension, history of myocardial infarction, type II diabetes mellitus, indigestion, trouble urinating, and headache.[5] Visual impairment has also been associated with an increased mortality rate.[6, 7]

Brenner et al found that driving at night was the single lifestyle activity impaired most by early cataract.[8] In the RAND-AMCC clinical appropriateness study, researchers concluded that vision-related functional impairment varied with age and gender.[9] Specifically, they reported that most subjects experienced more than one functional impairment (28% glare associated; 43% driving; 7% employment; 73% recreational impairment; 40% ADL impairment). More men than women experienced difficulty with work, driving and glare-associated impairment, while more

women than men experienced difficulty with activities of daily living. Furthermore, more patients age 70-79 cited impairment with driving and recreational limitations, while younger patients had more difficulty with employment, driving, and glare-associated impairment. The demand for cataract extraction is expected to increase as the population ages. Most countries with subsidized health care are struggling to keep up with the demand for this service, as demonstrated by the presence of waiting lists around the world.[10-14]

4. Outcome Studies

As described above 41 studies were described in the literature relating to baseline health state measures. These studies had numerous objectives such as “to study the relationship among different cataract surgery outcome measures” and “to identify preoperative characteristics associated with a lack of improvement on one or more measures 4 months after surgery.” These studies are summarized in Appendix C including details on the sample size, purpose, study design and measures used.

4.1 Measurement tools

For purposes of comparison, the measurement tools used in these studies are categorized as follows: measures of visual function; cataract symptom severity; combined visual function and cataract symptom severity; vision-related quality of life; and generic measures of well-being and functioning. Each tool is briefly described in Appendix D.

Eleven measurement tools describe visual function related to cataracts, each one identifying areas that make up visual function, and some providing “subscales” that can be scored individually. The most used of these tools is the VF-14 (Visual Function-14).[15] This scale has been modified to reduce the number of items and the time required to administer.[16, 17] The measures ask the respondent to rate their difficulty, from none to a great deal of difficulty, in performing vision-dependent activities of daily living.

Eight measurement tools describe cataract symptom severity, asking respondents to rate the severity of symptoms in such areas as glare or night vision or foggy vision. Two measures assessed both visual function and symptom severity. Some measures were designed to be used on any study population to measure a generic quality of life (QOL); one such generic tool, the Sickness Impact Profile, was also adapted for application to vision-related QOL (the VR-SIP).

4.2 Scores

Raw scores and clinical findings were abstracted from twenty four references, and inserted into a database (Appendix E, F, and G). For purposes of comparison, scores were “standardised” on a 0 - 100 [Worst - Best] scale as shown in the shaded rows in Appendix E, and rounded to two significant figures as discussed within the body of this report.

4.3 Case Mix

The studies varied substantially in their inclusion and exclusion criteria. Some studies reported outcomes for first (or second) eyes only, others reported on both eyes, and some studies restricted patient selection based on age criteria or on the presence (or absence) of co-existing ocular pathology. These differences in case mix are incorporated into the results (including tables) described below.

5. Baseline Visual Health Status Measures

Tables 1 - 3 summarizes the range of mean baseline (or pre-operative) scores for each of the various patient inclusion/exclusion criteria. Four outcome measures are addressed in these tables: visual acuity, visual function, cataract symptom severity and quality of life.

5.1 Visual Acuity

Most studies provided information on the patient’s preoperative and postoperative visual acuity, most commonly using the Snellen test. This clinical finding was mostly provided on the operative eye as best corrected visual acuity, and only rarely provided on both eyes or as a binocular acuity.

As expected, visual acuity appears to be slightly worse for patients having their first eye done (20/60 or worse), compared to the second eye-only patients (20/40 or worse). This reflects the fact that surgery is usually performed on the worse eye before proceeding to the second eye. There appears to be no significant difference in visual acuity between patients with or without coexistent ocular pathology (20/40 or worse for both). Patients older than 75 and/or where the dataset contains more than 50% ocular comorbidities were reported as having a mean VA of 20/70.

Table 1: Range of preoperative mean scores – Best Corrected Visual Acuity							
Measure (Worst – Best)	With ocular pathology	Without ocular pathology	1st eye only	2nd eye only	Ocular pathology ≥ 50%	Mean age ≥ 75	Mean age ≥ 75 and ocular pathology ≥ 50%
VA	20/40– 20/100 n=2277	20/40– 20/80 n=644	20/60– 20/100 n=739	20/40 – 20/70 n=911	20/70 n=556	20/40 – 20/70 n=737	20/70 n=464
[References]	[9, 10, 18-24]	[1, 20, 25, 26]	[19, 20, 24-27]	[9, 20]	[10, 23]	[21, 23]	[23]

5.2 Visual Function

Baseline data on visual function was the second most common data element to be provided within the outcome studies reviewed, mostly as a preoperative score.

The Activities of Daily Vision Scale (ADVS) covers 20 activities and has 5 subscales, where as the VF-14 was developed in 1994 by the Patient Outcomes Research Team (PORT) and contains 14 items. The VF-12 excludes driving items. The Javitt tool has 8 items and two subscales, combined for an overall score on visual function. Although no study was found that compared these scales, the tools all attempt to measure cataract-specific visual function, and for this reason will be compared as “all things being equal.”

The data shows that cataract patients generally present with a mean visual function score between 63 – 82, with zero meaning completely unable to function and 100 meaning fully functioning. Patients with ocular pathology appear to have a greater range and a lower baseline

score (63 – 82) than patients without ocular pathology (74 – 81). If only studies where the ocular comorbidity is less than 50%, then the range of preoperative mean scores is 69 – 78¹. There appears to be about a five point spread in the lower-range mean scores for patients without ocular pathology (74), patient groups containing less than 50% ocular pathology (69), and patients aged >75 (63). Scores on first eyes appear lower than second eyes, tending to confirm earlier observation that surgery is usually performed on the worse eye, when both eyes have cataracts present.

Measure 0 – 100 (Worst-Best)	With ocular pathology	Without ocular pathology	1st eye only	2nd eye only	Ocular pathology ≥ 50%	Mean age ≥ 75	Mean age ≥ 75 and ocular pathology ≥ 50%
ADVS	71 (63 – 78) n=426		67 n=224	72 n=168	68 (63 – 72) n=441	68 (63 – 72) n=441	68 (63 – 72) n=441
[Reference]	[22, 23, 29]		[23]	[23]	[23]	[23]	[23]
VF-14	71 (64 – 78) n=2387	76	71 (64 – 77) n=1427	73 n=243	71 (64 – 78) n=292	69 n=316	
[Reference]	[10, 19, 21, 24, 28, 30]	[15]	[15, 19, 24, 27, 30]	[28]	[10, 30]	[21]	
VF-12	80 (78– 82) n=552		80 (78 –82) n=552			79 n=220	
[Reference]	[17]		[17]			[17]	
Combined distance / near**	74 (71 – 76) n=119	78 (74 – 81) n=365	73 (71 –74) n=257	77 (72 - 81) n=152			
[Reference]	[20]	[20]	[20]	[20]			

*Median scores in bold above the (range of mean) scores

**Scores standardised to a 0 - 100 (Worst - best) scale for comparison.

5.3 Cataract Symptom Severity and Quality of Life

For purposes of efficiency, scores on quality of life measures and cataract symptom severity scores have been combined in the following table.

In the studies on satisfaction and trouble with vision (see Appendix E), most patients preoperatively report being dissatisfied or very dissatisfied (88% - 90%) with their vision, and report moderate or a great deal of trouble with vision (76% - 84%). The mean adjusted scores for cataract symptom severity (63 – 70) shows a minor range difference between patients with and without ocular pathology and with first and second eyes being done, suggesting either that all patients perceive about the same amount of symptoms or that the measures are not sensitive enough to detect difference in these groups. The mean ranges for quality of life scores also show only minor differences within the identified groups.

¹ Not shown in table, includes 2082 patients from references [19-22, 28]

Table 3: Range of preoperative mean and median scores* – Symptom and Quality of Life							
Measure (Worst - Best)	With ocular pathology	Without ocular pathology	1st eye only	2nd eye only	Ocular pathology ≥ 50%	Mean age ≥ 75	Mean age ≥ 75 and ocular pathology ≥ 50%
CSS**	67 (63 – 70) n=644		64 (63 –65) n=552	70 n=243	63 n=92		
[Reference]	[10, 19, 27, 28]		[19, 27]	[28]	[10]		
SIP**	90 (85 – 94) n=1640	92 n=717	90 (85 –94) n=1427		90 (85 – 94) n=1409	88 (87– 89) n=213	
Reference	[21, 24, 27, 30]	[15]	[15, 24, 27, 30]		[30]	[21]	
VR-SIP**	97 (95 – 98) n=783	98 n=717	97 (95 –98) n=735			98 n=213	
Reference	[21, 24, 27]	[15]	[15, 24, 27]			[21]	

*Median scores in bold above the (range of mean) scores

**Scores standardised to a 0 - 100 (Worst - best) scale for comparison.

5.4 Subscales

Mangione et al recently developed the National Eye Institute Visual Function Questionnaire (NEI-VFQ) to measure the impact of visual disability on health-related quality of life, where scores are provided for each of the 13 subscales.[31] In 93 patients whose ocular comorbidity was 60%, the lowest mean scores were for general vision (61), general health (64), and near vision (74). The highest scores were for color vision (90) and social functioning (91). Vision-related role functioning was virtually in the middle of this range (80).

6. Surgical Outcomes

6.1 Visual Acuity

Most patients report improved postoperative visual acuity by two to four months after cataract extraction. Patients undergoing surgery on either their first or second eyes have been shown to have a mean range of visual acuity between 20/25 – 20/40 post-operatively, as have patients who receive treatment on both eyes within the one year postoperative study period.

Table 4: Visual Acuity Surgical Outcomes						
	Value	Preop	2 – 4 mo.	1 yr.	n=	Reference
1st eye	Mean	20/60	20/25		552	[19, 32]
	Mean (range)*	20/80 (20/20 – LP)	20/25 (20/15-20/400)		155	[20]
	Mean (SD)*	0.54 +/- 0.12 (27 letters)	0.95 +/-0.15 (47.5 letters)		50	[26]
	Mean (range)	20/100 (20/25 - CF)	20/40 (20/20-CF)		72	[20]
2nd eye	Mean	20/70	20/25		121	[20]
	Mean	20/70	20/40		14	[20]
Both/or Bilateral	Mean	20/40	20/20		37	[20]
	Mean	20/50	20/25		15	[20]
	Mean (range)	20/70 (20/50 – 20/200)		20/40	426	[22]
	Mean	20/70 (20/25 – 20/200)		20/25 – 20/30	92	[10]
	Mean	20/70		20/40 (80%)	464	[23]
With Age Related Macular Degenera tion	Mean logMA R (Snellen equiv)	0.80 (6/38)	0.36 (6/12)		92/98	[18]

6.2 Visual Function

Seven studies provided data on the change of visual function scores postoperatively. Most studies included patients with co-existing ocular pathology. Patients without co-existing ocular pathology gained about 13 points on their visual function score, resulting in postoperative scores between 87 – 94 points.

Studies with a high prevalence of ocular comorbidities ($\geq 40\%$) showed average gains of 20 – 22 points, with resulting scores being a relatively modest 86 – 89.

Improvements in visual function did not depend on whether patients were having first eye surgery, second eye surgery only and/or bilateral surgery, with all groups reporting gains of between 11 – 17 points.

Table 5: Visual Function Surgical Outcomes							
Measure [Reference]	Inclusion	Without ocular comorbidities			With ocular comorbidities		
		Pre-operative	Post-operative	Change n=	Pre-operative	Post-operative	Change n =
1st eye only							
Combined distance/ Near* [20]		74	87	13 n=178	71	82	11 n=79
ADVS [23]					67	83	16 n=224
VF-12 [17]					79	96	17 n=82
VF-12 [17]	Age 50+				78	93	15 n=133
VF-12 [17]	Age ≥ 75				79	94	15 n=220
VF-14 [24]	> 50% ocular comorbidities, Barcelona				64	86	22 n=218
VF-14 [19, 32]					77	93	16 n=552
2st eye only							
Combined distance/ Near* [20]		81	94	13 n=138	72	88	16 n=14
Both, Bilateral							
Combined distance/ near* [20]		74	94	20 n=49	76	87	11 n=26
VF-14 [21]					69	89	20 n=316
VF-14 [10]					78	91	13 n=92
Control group							
Combined distance/ near* [20]		91	91	0 n=362	91	91	0 n=363

*Scores standardised to a 0 – 100 (Worst – Best) scale for comparison.

6.3 Cataract Symptom Severity and Quality of Life

All scores in the following table are adjusted for comparison so that they are on a 0 – 100 (Worst-Best) scale. All data reflect the presence of ocular comorbidities in study group.

The mean gain on the symptom scales was between 19 – 29 points, demonstrating an improvement in the disease-specific symptoms being treated surgically. In contrast, the quality of

life measures did not show significant gains, being between 2 and 4 points gained, with the most gain being noted in groups with high ocular comorbidities.

Measure / [Reference]	Inclusion	Preoperative	Postoperative	Change n =
CSS* / [27]	1 st	66	95	29 n=552
CSS* / [10]	Both	70	89	19 n=92
SIP* / [21]	Both	88	91	3 n=213
SIP* / [27]	1 st	93	95	2 n=552
SIP* / [24]	> 50% ocular comorbidities, Barcelona	85	89	4 n=218
VR-SIP* / [24]	> 50% ocular comorbidities, Barcelona	95	99	4 n=218

*Scores standardised for comparison on a 0 – 100 (Worst - Best) scale

6.4 Subscales

One study provided both preoperative and postoperative scores for subscales within a visual function tool. [10] In 92 patients studied, the most benefit was achieved in areas involving near vision, such as fine handwork and reading small print and books, as well as in driving at night. However, all subscales showed some improvement.

7. Prognostic Indicators of Treatment Benefit

The literature was reviewed for prognostic indicators associated with the degree of benefit likely to be experienced by patients receiving cataract surgery. Indicators include clinical measures (visual acuity, contrast sensitivity), age, ocular comorbidity, scores on disease-specific subjective measures (VF-14, VF-7, Cataract Symptom Score, Activities of Daily Vision), scores on generic subjective measures (Sickness Impact Profile or SF-36), and previous cataract removal (see Appendix G for summary).

A number of indicators were identified as being strongly or significantly correlated with the degree of benefit, while other indicators were identified as not having an independent correlation with benefit. The literature shows that the choice of surgical technique (phacoemulsification or extracapsular) does not affect clinical outcomes, whether measured by change in visual acuity or occurrence of postoperative adverse events.[32]

In the articles reviewed, benefit is considered to be the difference between preoperative and postoperative visual measures. Endpoints to measure benefit or improvement were most often defined as a positive change in the patient's visual functional status. However, other endpoints were also used to describe benefit, including a decrease in cataract symptoms, a gain in global measures of patient satisfaction or trouble with vision, or improvement in visual acuity alone.

7.1 Visual Acuity

A few articles suggest that there is little or no correlation between preoperative visual acuity and overall benefit (including measures of visual function) [2, 23, 24]. In the UK study on Cataract Outcomes, Desai found that clinical indicators such as Snellen visual acuity tend to underestimate overall benefit.[21] Though patients may have little improvement in their visual acuity, they often have greater improvement in other endpoint measures of visual function. These studies imply that visual acuity should not be used alone as a prognostic indicator. Indeed, patients can have significant symptoms despite having a good visual acuity. The PORT study showed that patients with a normal visual acuity had comparable improvements in symptoms and visual function following surgery as did patients with poorer pre-operative visual acuity, i.e., preoperative Snellen was not associated with the likelihood of improvement in symptoms or functioning.[19]

However some studies have used visual acuity as their main endpoint, such as the Regina Cataract study of waiting lists. In this study, pre-operative visual acuity was found to be the greatest predictor of postoperative acuity. Patients in this study had a high percentage (86%) of coexisting ocular pathology. [10] Similarly, a Park Nicollet Medical Foundation study defined a successful result as a postoperative visual acuity of 20/40 or better by three months.[33] This study found that greater age, poorer baseline visual acuity, and the presence of glaucoma, age-related macular degeneration, or diabetes-mellitus-related conditions resulted in reduced levels of improvement in postoperative visual acuity.

In a study of patients in Barcelona, Spain who took part in the International PORT study, preoperative visual function (as well as subjective measures VF-14 and the Cataract Symptom Scale) were associated with improvement, which was defined as a positive change in acuity. This cohort of patients had worse visual acuity and visual functional status than patients in the United States. Patients with worse visual function (VA, VF-14, CS-5; $P < 0.001$) were more likely to have a greater improvement.[24]

In a study of patients with and without co-existing eye disease, and using two control groups, Brenner et al. found that patients with low visual function (defined as low binocular visual acuity and poor scores on three subjective measures) showed greater increases in quality of life functions than did patients with relatively unimpaired pre-operative vision.[8] It was unclear to what extent visual acuity in isolation had any prognostic value on quality of life.

Finally, a study of patients with early cataract conducted at the Wilmer Eye Institute found that Snellen visual acuity did not predict how much vision improved in patients with visual impairment related to glare or low-contrast conditions.[3]

7.2 Visual Function

Several studies have shown that visual function before surgery is the strongest predictor of visual outcome and quality of life after cataract surgery, independent of visual acuity.[8, 19, 23] Disease specific measures of health status assess the specific symptoms or areas of disability that are of greatest clinical interest.[34] Appendix D provides a description of 11 visual function measures.

7.2.1 VF-14

Schein found that a preoperative VF-14 score of 90 or higher was associated with an increased likelihood of a failure to improve on one or more measures (odds ratio 2.10). The VF-14 was independently associated with a 21% - 27% greater likelihood of failure to benefit, compared to patients without any of these conditions, who are 9% - 14% more likely to fail.[19] The same conclusion was derived by Espallargues who associated a "worse VF-14" with a higher level of improvement ($P < 0.001$).[24]

7.2.2 VF-7

In a Finnish study, Uusitalo et al. were able to reduce the VF-14 down to seven questions (VF-7): night time driving; reading small print; watching television; seeing steps, stairs, or curbs; reading traffic, street, or store signs; cooking and doing fine handwork. Uusitalo concluded that the VF-7 was a strong predictor of change in patient satisfaction ($r = 0.56$ correlation) produced by cataract surgery.[16]

7.2.3 ADVS

Mangione et al concluded that preoperative ADVS scores were significantly correlated with surgical outcome (worse scores associated with better outcomes). Three categories of patients were identified, whose probabilities for substantial improvement were 85%, 34%, and 3%, respectively.[22]

7.3 Cataract Symptom Scale

Disease specific measures of health status assess the specific symptoms or areas of disability that are of greatest clinical interest.[34] Appendix D provides a description of 8 cataract symptoms measures.

Schein found that a preoperative Cataract Symptom Score (CSS, sometimes called CS-5) of 3 or less was associated with a significantly increased likelihood of not improving on one or more measures (odds ratio 3.29). The CSS was independently associated with a 21% - 27% greater likelihood of failure to benefit, compared to patients without any of these conditions, who were 9% - 14% more likely not to benefit.[19] Espallargues also noted a significant association between preoperative CSS and subsequent improvement.[24]

7.4 Generic QOL Measurement Tools

Generic measures reflect a patient's well being and general health state, and can be used across all health conditions. The Sickness Impact Profile (SIP), the Vision-related SIP (VR-SIP), and to a lesser extent the SF-36 are the measures used in cataract extraction outcomes assessments. Steinberg et al., reporting on the PORT data, found that the generic SIP measurement score did not capture improvements in functioning. Also, the Vision Related SIP was found to be less sensitive to functional impairment related to vision than is the VF-14.[32]

In contrast, Espallargues reported that Barcelona patients with better preoperative SIP scores had higher levels of improvement.[24] Although using the same methods as the PORT, this international study included patients with greater visual impairment than patients from the United States.

Mangione found that seven of eight subscales of the SF-36 worsened at one year after cataract extraction, despite improvement being demonstrated with the ADVS. Mangione concluded that the SF-36 is not sensitive enough to be used as a prognostic indicator of benefit or endpoint.[22] However, this may not necessarily be directly related to cataract extraction, given that the study population included patients older than 65 with or without other ocular conditions, and with or without other medical comorbidities.

7.5 Age

In the PORT study conducted in 1991, Schein et al. found that people 75 years of age or older were at increased risk of failing to improve on one or more outcome measures (odds ratio 3.57). Age was one of four factors identified as prognostic to a statistically significant extent. The mean adjusted rate of failure to improve on any of these outcomes measures ranged from 21% to 27% for patients with these preoperative characteristics compared with 9% to 14% for those patients without them.[19]

From the same PORT data, Tielsch reported that patients aged 50 - 64 achieved the greatest gain (20 points) in VF-14 scores, a subjective measure of visual function, compared to patients older than 75 who gained 15 points on average.[17]

Mangione et al., in their Massachusetts Eye and Ear Infirmary (MEEI) studied elderly patients aged 65 or older with and without other ocular conditions. Five predictors were identified and used to construct a prediction rule, which was then tested on a validation set. Age was identified as a predictor of improvement, with patients younger than 75 showing greater benefit. The main endpoint for benefit was change in the Activities of Daily Vision Scale (ADVS, a subjective measurement tool of visual function).[29] When applied to the validation set, the prediction model successfully stratified patients according to their likelihood of substantial improvement in the ADVS scores, being 85%, 34%, and 3%.[22]

As noted above, the Park-Nicollet study found that greater age, poorer baseline visual acuity, or the presence of glaucoma, age-related macular degeneration, or diabetes-mellitus-related conditions result in poorer postoperative visual acuity.[33]

7.6 Ocular Comorbidity

Several studies have shown a negative association between ocular comorbidity and surgical outcome. In a study at John Hopkins including first and second eyes with and without other ocular conditions, Javitt et al. concluded that patients with no ocular comorbidity were more likely to have greatest subjective improvement.[20] In the UK Cataract Outcome study, Desai concluded that an increased severity of co-existing ocular pathology was associated with increasing risk of poor visual outcome.[35] Willerscheidt found that the presence of known preoperative ocular comorbidities was associated with greater likelihood of poorer postoperative visual acuity[33] and Espallargues et al. found that lower levels of ocular comorbidity were associated with higher levels of improvement ($p < 0.05$).[24]

Schein et al. observed that the presence of ocular comorbidities was associated with a 21% to 27% greater likelihood of failure to benefit, compared to patients without any of these conditions, who are 9% - 14% more likely to fail. The odds ratio for ocular comorbidity was 2.16.[19]

Uusitalo found that patients with ocular comorbidity was associated with higher incidence of postop complications.[36] Mangione et al. concluded that the presence of posterior subcapsular cataract (P=0.09), and the absence of age-related macular degeneration (p=0.07) and/or diabetes (p=0.006) were predictors of improvement.[22]

7.7 Previous Cataract Removal

Hadijstavropoulos found that patients having second eye cataract extraction had the greatest improvement in postoperative visual acuity, and concluded that previous cataract removal is a predictor of benefit.[10] In a randomised trial of expedited second eye cataract extraction, Laidlaw et al. concluded that the outcome was better if second eye was done soon after the first procedure, rather than later.[37] Javitt et al. concluded that improvement associated with second eye surgery was greatest in older patients.[28]

7.8 Contrast sensitivity

A few studies have reported an association between pre-operative contrast sensitivity in diagnosis of early cataract. Rubin et al studied 72 patients with 20/80 VA or better (and no ocular comorbidity) and determined that improvement in disability glare and contrast sensitivity is not correlated to preoperative visual acuity, ie there can be significant disability glare despite a good VA.[3] Furthermore, the patients with the poorest preoperative VA and contrast sensitivity scores were as likely to regain normal function as those with the best preoperative scores. Pfoff et al studied 127 patients with 20/50 or better Snellen and showed that there is a large number of patients with normal Snellen who are functionally impaired and who would benefit from surgery.[2] Adamsons et al report that the greater the degree of preoperative impairment in objective vision function as measured by visual acuity and contrast sensitivity, the greater the postoperative improvement in subjective visual function.[1]

8. Conclusion

This review of the cataract surgery literature has focused on three questions: (1) pre-operative severity of illness, (2) the degree of benefit observed with cataract surgery, and (3) predictors of benefit. Regarding pre-operative severity, best-corrected Snellen visual acuities ranged from about 20/40 to 20/70, depending on the case-mix of patients included in the studies. This represents a mild to moderate degree of impairment. Most measures of visual function indicated that patients experience approximately a 25-30% reduction in visual function pre-operatively. The extent to which it does not translates into dissatisfaction with symptoms and overall quality of life varied across studies, ranging from about a 2% to a 35% reduction in quality of life, depending on which instrument was used.

The outcomes of cataract surgery were uniformly favourable, at least when considered across groups of patients. Post-operative visual acuities were typically in the range of 20/25 – 20/40, representing an improvement of three or four lines on the Snellen chart, on average. Improvements in visual function ranged from about 10 to 20 points on a normalized 0 – 100 scale, with post-operative functioning above 90 percent of normal being typical. Improvement in overall quality of life and satisfaction was much lower due to the lesser degrees of pre-operative impairment observed in these domains.

The most potent predictor of improvement with surgery is the degree of pre-operative visual impairment, with greater pre-operative impairment associated with greater degrees of improvement. Whether pre-operative visual health status is best measured by visual acuity, visual function, or some other measure (e.g. contrast sensitivity) is less clear, although visual acuity alone is probably not adequate. Additional significant predictors of positive benefit include the absence of comorbidity, age < 75, and, perhaps, second eye surgery.

Contrariwise, the finding of a minimal reduction in visual acuity or visual function is associated with reduced levels of benefit from surgery, as does the presence of comorbidity or age > 75. The relationship of first vs. second eye surgery to degree of benefit is a complicated one, although the literature does tend to support the view that second eye surgery provides a degree of benefit comparable to that seen in first eye surgery.

Appendix H contains draft priority criteria that members of the panel will use as a starting place for designing criteria suitable for Canada. Developed in 1992 by Hadorn et al for the New Zealand Ministry of Health [11], it is contained herein for convenience, in the hopes that the information provided in this report will be useful in its review.

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Cataract Surgery Literature Review Appendix A: Search Terms

Search strings specified retrieval of records published between 1989 and 1999, and articles written in English, or which had an English abstract in the NLM database. MeSH terms used to retrieve articles on Relevant Research Topics within the medical service topic cataract extraction [majr:noexp], entered with Boolean connector “OR”:

- Activities of daily living
- Age factors
- Age of onset
- APACHE
- Contrast sensitivity
- Cost allocation
- Cost-benefit analysis
- Cost control
- Cost savings
- Costs and cost analysis
- Decision making [mh:noexp]
- Delphi technique
- Disability evaluation
- Economic value of life
- Evaluation studies
- Geriatric assessment
- Health care costs [mh:noexp]
- Health care rationing health priorities
- Health services needs and demand [mh:noexp]
- Health status
- Karnofsky performance status
- Medical futility
- Needs assessment
- Nutritional status
- Outcome assessment
- Patient satisfaction
- Patient selection
- Population surveillance
- Predictive value of tests
- Quality-adjusted life years
- Quality of life
- Questionnaires
- Reference standards
- Risk factors
- Self assessment psychology
- Sentinel surveillance
- Severity of illness index
- Social responsibility
- Surgical procedures, elective/utilization
- Surgical procedures, operative/standards
- Time factors
- Treatment failure
- Treatment outcome
- Visual acuity
- Waiting lists
- Work capacity evaluation.

The following terms were entered in the search string with the Boolean connector “NOT” to exclude articles with main headings within topics that would not likely address the research questions:

- Radiography [mh] or radiography [sh]
- Feasibility studies
- Intraoperative care
- Postoperative care
- Comorbidity
- Sensitivity
- Specificity

- Case report
- Comparative studies
- Length of stay.

Additional terms included:

- Disability evaluation [mh]

- Function recovery
- ADL [textword]
- Disease management [mh]
- Delivery of health care/standards [mh]
- Outcome & process assessment (health care) [mh].

Key word search by concept:

- Criteria
- Grading
- Outcome
- Priority
- Severity
- Timing
- Urgency
- Disability rating
- Disability scales
- Functional impairment.

Key word search by specific tests:

- SF-36 or Short Form Health Survey
- MOS or Medical Outcomes Study
- ADVS or Activities of Daily Vision Scale
- VF-14 or VF-12 or Visual Function-14.

Research articles with the following types of limited topical interest were excluded from the Primary Search during a “false drop filter” conducted by the Medical Library Research Specialist, as follows:

- a particular type of procedure, material or surgical method
- comparison of surgical methods
- preoperative, perioperative, postoperative care
- outcomes related to particular technique
- surgical complications
- patient guides
- gender utilization
- patient selection based on medical considerations only
- rehabilitation
- articles in foreign languages which had summaries too brief or general to be useful
- research methods.

Cataract Surgery Literature Review Appendix B: ACT

WCWLP
Article Coding Template

Article ID:	First Author:	Year of publication:
Title:		
Rating of overall usefulness of article to study questions:		Blank
Reviewer summary:		
Study name or center:		
Kind of study:	Case series(fol'd thrgh time, no control group)	
Sample size:		
Study methods:		
Study's Inclusion criteria:		
Study's Exclusion criteria:		
PRE-SERVICE HEALTH STATE (Baseline Measurement)		Blank
1. Does paper describe the <i>kinds of patients</i> with the condition, regarding GENERIC health state (ie QOL, functional impairment) or DISEASE SPECIFIC health state (degree of suffering, visual acuity, mobility)?		
1a. If yes, how were they measured (what questionnaire[s] were used or factors assessed)?		
1b. Did paper distinguish among patients with <i>differing levels</i> of severity (e.g., mildly, moderately, severely affected; a scoring system with 100 representing absence of any suffering or impairment)?		Blank
1b1. If yes, what were the definitions of the ratings (range of scores, description)?		

1b2. If yes, how many patients were in the categories?

1c. Does this method of grading severity allow comparison across different medical conditions? Blank

Comments about above:

HEALTH SERVICE BENEFIT (Outcome Measurement)

Blank

2. Does paper describe postoperative degree of suffering, functional impairment, quality of life, or clinical symptoms?

2a. If yes, how were they measured (what questionnaire[s] were used or factors assessed)?

2b. Did paper provide information to assess post-operative severity relative to pre-operative severity? Blank

2b1. If yes, did paper permit quantitative estimation of degree of benefit? Blank

2b2. What was the degree of quantitative benefit (either in relative or absolute terms)?

2c. Does this method of measuring outcome allow comparisons across medical services? Blank

Comments about above:

PROGNOSTIC INDICATORS

3. Did paper provide a basis for predicting which patients will benefit more or less than average (e.g., prediction models/rules for estimating small, medium, large benefit)? Blank

If yes, what were the distinguishing factors?

Save the form as a document in the ACT Document folder. Data elements will be extracted at the end of the review by AB.

Cataract Surgery Literature Review Appendix C: Outcome Studies Reviewed

Study	n=	Design	Measurements	Purpose
Baltimore Cataract Patient Outcomes Reseach Team [25]	47	Study of “age-related” cataract (exclude congenital cataracts), where patients rank preferences for current and 3 hypothetical health states. First eye only with no other ocular comorbidity.	Visual Acuity (Snellen); demographics, employment status, education, eight aspects of daily life derived from focus groups.	To assess how preference values for pre-op visual state relate to VA and problems in specific aspects of daily life.
Bascom Palmer Eye Institute Low-vision Clinic 1995-96 [38]	156	Interview patients from low-vision service, taken one week before and 3 months after their low-vision clinic visit.	Visual acuity; SF-36; VF-14; field test version of the National Eye Institute Visual Functioning Questionnaire (NEI-VFQ)	To investigate the functional status and quality of life at a low vision clinic and to evaluate the impact of low-vision services. This study shows the responsiveness of the generic/disease specific tools (SF-36 and VF-14). Confirms Lee et al’s findings on the impact of vision on QOL. SF-36, VF-14, and NEI-VFQ demonstrate that low-vision clinic patients perceive marked impairment.
Bristol Study of Second eye cataract surgery 1994-95 [37]	208	Random allocation of waiting time (within 6 weeks versus within 7-12 months) for second eye surgery, without visually significant ophthalmic pathology.	Visual Acuity (binocular LogMAR); demographics; self-completed vision related questionnaire; and a ‘battery’ of visual function tests (Reading acuity, Pelli-Robson contrast sensitivity, and stereoacuity); and SF-36.	To examine effects of second eye surgery on patient perception of visual function and on battery of vision tests, and to compare with expediated cohort.
Bristol/ARM study 1997 [18]	99	Random sampling of ARM patients; data collected from case notes and a simple, self completed questionnaire sent to patient’s home. Population study includes aged 50 and over, cataract extraction during 1994 at Bristol Eye Hospital, ARM reference in ocular diagnosis.	Visual Acuity (Snellen), ocular history, systemic diagnoses.	To assess the benefits of cataract extraction in patients with age related maculopathy.

Study	n=	Design	Measurements	Purpose
Cataract PORT [32]	717	Medicare beneficiaries in three cities, stratified random sampling, no significant ocular comorbidity, first eye surgery. Measures taken by interview.	Preoperative and perioperative clinical symptoms, surgical technique, and Snellen visual acuity.	To examine associations between surgical technique, patient and surgeon characteristics, and clinical outcomes of cataract surgery
Cataract PORT [27]	552	As above	Visual acuity test (Snellen); VF-14 test; Satisfaction questionnaire; trouble with vision questionnaire; the Cataract Symptom Score; the Sickness Impact Profile (SIP); a Vision-related Sickness Impact Profile; Functional Assessment Inventory; ocular history and comorbidities preoperatively.	To study relation among different cataract surgery outcome measures.
Cataract PORT [15]	766	As above	Visual acuity (best corrected in each eye); VF-14; Patient reports of trouble and satisfaction with vision; SIP, VR-SIP, Cataract Symptom Score (CSS), Functional Assessment Inventory to measure medical comorbidity.	To describe the development and performance of a brief questionnaire designed to measure functional impairment caused by cataract (the VF-14).
Cataract PORT 1991 [19]	552	As above	Snellen visual acuity test; VF-14 test; Global measures of trouble and satisfaction with vision; Cataract Symptom Score; ocular history and examination.	To identify preoperative characteristics associated with a lack of improvement on one or more measures 4 months after surgery.
Cataract PORT [39]	426	As above	Visual acuity (Snellen); VF-14; SIP; global measures of satisfaction and trouble; overall health	To compare generic health status measure and a disease specific measure in detecting functional impairment.
Cataract PORT [17]	552	As above	Visual acuity test (Snellen); a modified VF-14 test (the 'VF-12' has no questions on driving); a Trouble and Satisfaction questionnaire; the SIP; a rating of expectations; ocular history.	To describe relationship between patient's preoperative expectation regarding outcome of cataract removal, and actual outcome.

Study	n=	Design	Measurements	Purpose
Cataract PORT [28]	243	Same as PORT except looks at only second cataract extraction before 4 months postoperative first eye.	Visual Acuity; CSS; VF-14 and global measure of trouble and satisfaction with vision	To measure effect of second eye cataract extraction and compare with first.
International PORT [24]	218	Multicentre observational study of first eye surgery in Barcelona Spain using data extracted from records or from standardised interviews. Included patients with ocular comorbidities.	Visual acuity; VF-14, Cataract Symptom Score (CSS); Sickness Impact Profile (SIP); and global measures of patient's trouble and satisfaction with vision; ocular and medical comorbidity,	To describe impact of cataract surgery on visual function and health status, and to identify patient characteristics that might affect outcomes.
International PORT [40]	1407		Visual Acuity (Snellen, best corrected in each eye); VF-14; SIP; CSS; global measure of patient's trouble and satisfaction with vision.	To demonstrate reliability, validity and responsiveness of VF-14 in Manitoba, Denmark, Barcelona, and USA.
International PORT [41]	1409	As for PORT, plus shows cohort controlled for normal retina and macula, and other significant ocular comorbidities	VF-14; Visual Acuity (Snellen); SIP; demographics; ocular comorbidity.	To assess variations in indications for cataract extraction in US, Denmark, Canada, and Spain.
Danish Study 1985-87 [42]	1925 2	First eye surgery followed for 4-6 years.		To estimate risk of retinal detachment following cataract extraction in Denmark, and compare with USA PORT data.
Finnish [36]	219	Adverse events occurring within 24 hours and 4 months compared with global measures of vision in first and second eyes.		To analyze the association between surgical astigmatism and global measures of vision.
Finnish 1997-98 [16]	142	Measurements taken at baseline and 4 months postop by interview of first eye cataract removal.	Visual acuity (Snellen); VF-7; VF-14; patient perception of trouble and satisfaction with vision; CSS.	To develop and evaluate a 7 item visual functioning index to assess the functional status and QOL changes.
Helsinki cataract depression study [43]	100	Case series study of first eye surgery on patients aged 71 to 76 years. Measures taken one day before the operation and 3 months after, by exam and interview.	Visual acuity (E-test); Beck Depression Inventory; personality test (Mini-Multi MMPI).	To investigate the association between depression and vision.

Study	n=	Design	Measurements	Purpose
Italian study of early cataracts 1995 [26]	50	No other ocular disease.	Visual acuity, lens opacity, glare disability, contrast sensitivity	To assess visual tests and subjective benefit score in patients with preoperative VA 0.4 (20/40) or better.
John Hopkins 1987-88 [8]	1021	Prospective study with measurements taken on ophthalmology patients (by interview and abstraction) from three cities (San Diego, Baltimore, St Louis). Includes first and second eyes, with and without ocular comorbidities, and 2 control groups (no cataracts with other ocular disease, no cataracts and no other ocular disease).	Visual acuity (Snellen - Applegate binocular method, and both left and right); Symptom Scale (vision specific); Visual Function drawn from Comprehensive Assessment and Referral Evaluation Interview (with three subscales of Near, Middle, and Distance); Current Vision; Psychological status; social functioning; general well being.	To test hypothesis that a positive monotonic relationship exists between vision and QOL functions (improved vision = improved QOL and visa versa).
John Hopkins [20]	1021		Visual acuity; Symptom Scale (vision specific); Visual Function tests (two subscales Near and Distance)	To identify subjective assessment of visual function and qol before and after cataract extraction, and compare with ophthalmic patients who do not have vision impairing cataracts.
John Hopkins/Wilmer Eye Institute [3]	72	Cases series including patients with senile cataract with equal or better vision than 20/80 and no ocular abnormality, or has expressed trouble with ADL/driving/function. Measurements taken before and 3-4 months after cataract extraction.	Visual acuity (Early Treatment Diabetic Retinopathy Study with background luminance); contrast sensitivity with Pelli-Robson Letter Chart; Glare with brightness acuity tester.	To compare acuity, contrast sensitivity, and disability glare before and after cataract surgery
Massachusetts Eye and Ear Infirmary (MEEI) [29]	334	Study of patients 65 or older with or without ocular comorbidities, and measurements taken at baseline, 3 months and one year.	ADVS, Physical functioning section of the SF-36 for validity testing, Visual Acuity (Snellen); Global rating question for binocular best-corrected preoperative vision, Global category rating question for best-corrected preoperative vision.	To develop a method for the evaluation of visual function in subjects with cataracts.

Study	n=	Design	Measurements	Purpose
Massachusetts Eye and Ear Infirmary (MEEI) [23]	464	As above	Activities of Daily Vision Scale (ADVS); SF-36; Visual Acuity (Snellen); Ocular comorbidities; chronic medical conditions and medications.	To measure effect of cataract extraction and lens implantation on elderly persons HRQOL and visual activities.
Massachusetts Eye and Ear Infirmary (MEEI) [22]	426	As above	Activities of Daily Vision Scale (ADVS); Visual Acuity (Snellen); Ocular comorbidities; chronic medical conditions and medications.	To develop a model to predict visual functional improvement after cataract extraction with intraocular lens implantation based on preoperative data.
National Eye Institute Visual Function Questionnaire 1998 [31]	598	Measurement tool was developed with focus group and then tested on a cohort of cataract patients.	NEI-VFQ Data, cross comparison of subscales by condition (ARMD, Diabetic retinopathy, glaucoma, low vision, CMV retinitis). Methods says that SF-36 and either the ADVS or the VF-14 was measured but no results referenced.	To assess reliability and validity of a new vision-targeted measure of QOL, the NEI-VFQ.
National Institute on Aging 1993 [2]	127	Sample patients include significant cataracts (Snellen 20/50 or better or complaints of nite time glare/contrast below normal, or not driving at nite). Measurements taken before and 8 months after cataract extraction and compared with non-surgical control group.	Visual acuity (Snellen), Contrast sensitivity, glare.	To evaluate effect of cataract extraction in patients with early cataracts.
Nepal study of cataracts [44]	776	Random sampling using a stratified cluster design with door to door enumeration of persons aged over 45 followed by eye examinations at village sites. Measures taken by exam and standardised interview.	Visual Acuity (Snellen); Visual Function questionnaire; Quality of Life questionnaire.	To present results on cataract surgery outcomes as assessed in a population in Nepal.

Study	n=	Design	Measurements	Purpose
Park Nicollet Medical Foundation 1986-89 [33]	791	Study of first and second eyes with and without ocular comorbidities and with or without general health comorbidities.	Visual acuity, intraoperative and postoperative events, ocular history, comorbidities, demographics.	To assess impact of comorbidities on visual acuity after cataract extraction.
RAND 1986 [5]	1642	Cross sectional analysis of MOS 2 year follow-up data.	SF-36; Demographics, medical comorbidities looking at the occurrence and impact of blurred vision on functional status and well-being.	To study impact of blurred vision on functional status and well being.
RAND-AMCC Clinical Appropriateness Initiative [9]	776	Preoperative measures abstracted from medical records.	Visual Acuity; demographics; functional impairment.	To determine relationship between visual functional impairment and (gender, age, preop VA, and other ocular disease).
Regina Cataract Surgery 1997 [10]	92	Prospective study involving patient interviews and inter-observer-based data on visual functioning before and after first and second eye cataract extraction. The study compares whether ophthalmologists perform surgery within unwritten 'standards' (6/60 or less within 3 months; 6/18 or less within 1 year).	Visual acuity (ranking 1 to 15 20/20 to 200/2000); VF-14; Cataract Symptom Score, Beck Anxiety Inventory	To examine quality of decision for managing waiting list of cataract patients and to investigate impact of waiting period on outcomes.
Swedish study 1993 (Pre-Catquest) [45]	139	Cases series involving structured interviews and exam prior to and 6 months after cataract surgery. One or both eyes, without other ocular disease.	Visual acuity (Monoyer-Granstrom), and questions re 37 activities within 8 main areas of daily life, and a question re overall quality of life, and whether the patient thought their QOL was affected by their visual problems. The questions related to problems with the activity (rather than ability to perform), and grading the frequency.	To identify most commonly perceived disability in daily life caused by bad vision; to rank perceived problems with regard to frequency and weight; to identify what extent the perceived problems are affected by a successful cataract extraction; and to outline a minimum number of decisive questions about visual disabilities.

Study	n=	Design	Measurements	Purpose
Swedish Ophthalmology Study 1995 [46]	1417	Test and retest on cataract and non-cataract patients (control group) without other eye disease on first and second eyes.	Catquest	To report on development and testing of Catquest, a new tool for continuous quality control regarding appropriateness and outcome of surgery.
Swedish CATQUEST study [47]	1933	Case series where measurement taken by mail questionnaire and exam prior to and 6 months after cataract extraction. Study includes first and second eyes, with and without ocular comorbidities, and with or without combined eye procedures.	Catquest, a self-administered; Visual Acuity (Monoyer-Granstrom letter chart, best corrected visual acuity (BCVA).	To report on outcomes using Catquest and discuss validity.
UK National Cataract Surgery Survey 1990 [35]	998	Prospective cross sectional surgery for age related cataracts within UK national health Service where VA abstracted from medical records, including first and second eyes, with or without ocular comorbidity.	Visual Acuity (Snellen); surgical complications	To report on short-term clinical outcomes of cataract extraction.
UK National Cataract Surgery Survey [48]	998		Visual acuity	
UK Cataract Symptom Scale 1999 [49]	162	A 15 item scale was derived and then tested on a cohort of persons with age-related cataract, first or second eye cataract extraction.	Visual acuity; Cataract Symptom Scale (CSS); VF-14; Nottingham Extended ADL; General Health Questionnaire; Hospital anxiety and depression score.	To develop and test a cataract symptom score.
UK Cataract Outcome Study 1993-94 [21]	337	Observational, longitudinal study of cataract patients in three districts of London.	VF-14; SIP; Vision Related SIP	To describe the impact of cataract surgery in terms of visual function and health related quality of life.
UK Northern Region 1994 [14]	160	VA and degree of handicap was abstracted from the medical record.	Visual acuity (Snellen) of both eyes; degree of handicap	To identify criteria used by ophthalmologists to determine who needs cataract surgery.

Study	n=	Design	Measurements	Purpose
Wilmer Eye Institute [1]	67	Cases series on patients with early cataract where measurements taken prior to and 4 months after cataract surgery by exam and structured interview.	Visual acuity (ETDR, presented in Snellen acuity); Visual impairment questionnaire; lens grading; contrast sensitivity (Pell-Robson); glare test; cathode-ray tube.	To evaluate the association of subjective visual function with objective measures of acuity, glare, and contrast sensitivity in patients who were symptomatic from early cataract.

Cataract Surgery Literature Review Appendix D: Measurement Tools

The following tables document the measurement tools mentioned in the literature reviewed, as described in the key references noted. Although similar in many ways in what they attempt to measure, the tools are presented here, under the following headings: visual function, cataract symptom severity, combined vision-related function and symptom, vision-related quality of life, and generic quality of life.

Visual function

Tool	Worst – Best	Description	Details - Subscales
VF-14 [15]	0 - 100	<p><u>Visual Function – 14</u> 14 items. Measures the amount of difficulty with performing 14 vision-dependent activities of daily living. Each question has 5 response options: 4 = no difficulty; 3 = a little difficulty; 2 = a moderate difficulty; 1 = a great deal of difficulty; 0 if unable to do the activity b/c vision. The mean of all responses are then multiplied by 25 to convert into a 100 point scale.</p> <p>0 = unable to do all applicable activities; 100 = able to do all applicable items without difficulty.</p> <p>An item was excluded from the scoring if the person did not do the activity for another reason other than vision.</p>	Reading small print; reading a newspaper or book; reading large-print book or newspaper; recognizing people when they are close; seeing steps, stairs or curbs; reading traffic, street, or store signs; doing fine handwork such as sewing, knitting, crocheting or carpentry; writing checks or filling out forms; playing games such as bingo, cards; taking part in sports such as bowling, tennis, golf; cooking, watching television; Driving during day and night.
VF-12 [17]	0 - 100	<p><u>Visual Function – 12</u> 12 items, same as VF-14 without 2 items on driving. The mean of all responses is multiplied by 25 to convert into a 100 point scale.</p>	As above without driving during the day and driving during the night.
VF-7 [16]	0 - 100	<p><u>Visual Function – 7</u> 7 items, same as VF-14 without 7 items with low correlational data. The mean of all responses is multiplied by 25 to convert into a 100 point scale.</p>	Night time driving; reading small print; watching television; seeing steps, stairs, or curbs; reading traffic, street, or store signs; cooking and doing fine handwork.
VF-14 (CAN) [10]	4 – 0	<p><u>Visual Function – 14 (CAN)</u> As above for VF-14, except items are scored on a scale of 0 – 4 with lower scores indicating better ability to carry out the activity.</p>	As above for VF-14.

Tool	Worst – Best	Description	Details - Subscales
NEI-VFQ [31, 38]	0 – 100	<p><u>National Eye Institute Visual Function Questionnaire</u> 51 items, 13 subscales, measures the influence of visual disability on Health Related Quality Of Life (QRQOL) and is not specific to cataract. Includes multi-item scales to rate overall health on a 5-level scale that ranges from excellent to poor; and overall vision on a 6-level scales that ranges from excellent to blind. Developed by same group who developed ADVS.</p> <p>0 = worse possible health; 100 = best possible score.</p>	Subscales: general health , general vision, visual pain, near activities, distance activities, vision-specific expectations, vision-specific mental health, vision-specific expectations, vision-specific role difficulties, vision-specific dependency, driving, color vision, and peripheral vision.
ADVS [29]	0 - 100	<p><u>Activities of Daily Vision</u> 20 items/activities, 5 subscales (each can be scored separately) and an overall or composite score calculated from the unweighted mean of all the answered items in questionnaire. Responses include “no difficulty at all”, “a little difficulty”, “moderate difficulty”, and “extreme difficulty.”</p> <p>Global category question is a descriptive scale of overall corrected vision (excellent, good, fair, poor, or blind).</p> <p>0 = activity no longer performed; 100= no difficulty with any of the vision activities</p>	Subscales: distance vision that does not require driving; near vision activities; glare disability; night driving; and daytime driving. Between 3-9 questions per subscales.
Vision Disability Assessment [50]	Unclear	<p><u>Vision Disability Assessment</u> 18 items, scored on a four point scale. Scores were averaged to create an overall index of visual disability, as well as subscale indices for mobility related disability, distance/lighting/reading related disability, and near and related tasks visual disability.</p> <p>Article not available; reviewed from abstract only.</p>	Measures patient’s assessment of his/her ability to perform each task.

Tool	Worst – Best	Description	Details - Subscales
VF Nepal 1999 [44]	0 – 100	<p><u>Visual Function Nepal</u> 13 items, includes one general statement assessing overall vision and four subscales. Total VF scores were calculated as an equally weighted average of the four subscales scores, and does not include the general vision question. Within subscales, questions are also equally weighted.</p> <p>0 = worst health; 100 = best health</p>	<p>Subscales: visual perception (activity limitation, near vision, intermediate vision, distance vision); peripheral vision (one item); sensory adaptation (light/dark adaptation, visual search, color discrimination, glare disability); depth perception (one item).</p>
Combined distance/ near vision [20]	1 - 3	<p><u>Combined distance/near vision (Javitt)</u> 8 items with 2 subscales (4 items on Near and 4 items on Distance) which are scored separately as follows: always (1), sometimes (2), never (3), not of interest (4), refused (7), do not know (9).</p> <p>Scores 3 and over are replaced with the mean of the other questions, and given a score range of 1 - 3, the higher value reflecting better vision. Scores are totaled and divided by either 4 (for subscale mean) or 8 (for total combined mean).</p> <p>1 = worst vision; 3 = best vision</p>	<p>8 items which measure visual function, not enunciated.</p>
Visual Function Brenner [8]	descriptive	<p><u>Visual Function Brenner</u> 8 items drawn from Comprehensive Assessment and Referral Evaluation Interview with three subscales (Near, Middle, Distance). Response options include: always, sometimes, never/ not of interest</p> <p>Unclear if numerical value applied to response options.</p>	<p>Near: Does your sight make it a problem for you to read newspapers? Read a telephone directory? Read labels? Read prices? Middle: Recognize people? See steps? See cracks in the sidewalk? Far: See traffic signs?</p>

Tool	Worst – Best	Description	Details - Subscales
Visual Function Tobacman [9]	0 – 100%	<u>Visual Function Tobacman</u> 5 items which reflect percentage of perceived impairment in the study population. 0 – no impairment; 100 – greatest impairment.	Unable to perform ADL; unable to drive due to visual impairment; unable to work due to visual acuity; unable to perform recreational activities, watch television, or read due to visual impairment; unable to perform activities due to disabling glare; has nonspecified visual impairment; has no visual impairment.

Cataract Symptom Severity

Tool	Worst – Best	Description	Details - Subscales
CSS, CS –5 [19, 27, 28]	15 – 0	<u>Cataract Symptoms Scale USA</u> 5 items on cataract symptoms, scored individually and then summed. 0 = not bothered, 1= little bothered; 2 = somewhat bothered; 3 = very bothered. 0 = not bothered by cataract symptoms; 15 = very bothered by cataract symptoms.	Double or distorted vision; glare; halo or seeing rings around light; blurry vision; colors looking different than they used to or worsening vision in last month.
UK Cataract Symptom Scale [49]	Unclear	<u>Cataract Symptoms Scale UK</u> 12 items graded on a five point scale. Score based on a percentage of the sum. A high score indicates greater visual symptoms than a low score.	Getting off the pavement; going down stairs; crossing the road; reading small print; reading books and newspapers; seeing television subtitles/teletext/ seeing the numbers on a bus; bright light behind to read; recognizing someone across the street; watching television; hot drinks; seeing to write.
Cataract Symptoms Score (CSS CAN) [10]	3-0	<u>Cataract Symptoms Scale CAN</u> Five symptoms rated on three point scale with 0 meaning “not bothered” and 3 meaning “very bothered”. Scores averaged to provide overall score of cataract symptomatology.	Double or distorted vision, glare.
Symptom level [8]	Not stated	<u>Symptom level (Brenner)</u> 6 items, graded on a three point descriptive scale, summed for scoring.	Night time vision, seeing rings around lights, glare, hazy vision, blurry vision, trouble seeing in dim or poor light. Responses include: always, sometimes, never

Tool	Worst – Best	Description	Details - Subscales
Trouble with vision [15]	Descriptive	<p><u>Trouble with vision (Steinberg)</u> Global rating on patient’s perceived trouble with vision, rated on a four point descriptive scale: none, a little, a moderate amount, or a great deal.</p> <p>A mean change of –1 in the study data indicates an improvement of one category.</p>	How much trouble do you experience with your vision?
Satisfaction with vision [15]	Descriptive	<p><u>Satisfaction</u> Global rating on patient’s perceived satisfaction with vision, rated on a four point descriptive scale: Dissatisfied / Very Dissatisfied.</p> <p>A mean change of –1 in the study data indicates an improvement of one category.</p>	How satisfied are you with your vision.
Current vision [8]	1 - 5	<p><u>Current vision (Brenner)</u> 1 item on a patient’s cognitive perception of visual capability using a 5 point descriptive scale.</p> <p>1 = very poor; 2 = poor; 3 = fair; 4 = good; 5 = excellent.</p>	One item: “How is your vision now?”
Global vision [29]	0 - 100	<p><u>Global vision</u> Global category question is a descriptive scale of overall corrected vision (excellent, good, fair, poor, or blind). The global rating of vision is scale of 1-100 with 100 being excellent vision and 0 is blindness.</p> <p>0 = blindness; 100 = excellent vision.</p>	How best to describe vision.

Combined visual function and cataract symptom severity

Tool	Worst – Best	Description	Details - Subscales
TyPE questionnaire [51]	Unclear	<p><u>TyPE Questionnaire</u> 15 item, three subscales (distance vision function; near vision function; glare) and composite of visual function data item scores. Rating on a five point scale. Rating of vision: poor, fair, good, very good, excellent.</p>	<p>Self rate of vision; how much does vision hinder activities (usual daily activities; recognizing people; reading prices or label; reading a magazine, newspaper or book; knitting or sewing; watching television; daytime driving; nite time driving); how much are you hindered by glare (usual daily activities; reading shiny paper; driving towards the sun or oncoming headlights; walking outside on a sunny day); a question on who filled out the form; and a yes/now question on recent illness or injury.</p>
Catquest [46]	Unclear	<p><u>Catquest</u> 21 items with three subscales (frequency of activities, disability, symptoms) plus global rating. 12 questions on frequency to determine person’s activity level, ranked 0-4; 7 questions on disability to determine areas of life negatively affected by vision, ranked 0-5; 1 question on cataract symptoms, ranked 0-4; and global rating (0-4).</p> <p>Response options include: “Activity level” - high (daily), moderate (2-4 x week), low activity (once week), no activity; “disability” and “cataract symptom:- no difficulty, some difficulty, much difficulty, extreme difficulty, cannot say; “global rating” - very satisfied, rather satisfied, rather dissatisfied, very dissatisfied.</p>	<p>Reading newspaper print, seeing prices of goods when shopping, seeing to walk on uneven ground, seeing to do needlework or other handicraft, reading television text, see to carry out a preferred hobby.</p> <p>Scores are considered within a “Health matrix” to estimate benefit.</p>

Vision-related Quality of Life

Tool	Worst – Best	Description	Details - Subscales
VR-SIP [15, 27]	100 - 0	<u>Vision-related Sickness Impact Profile</u> 136 items, a behavior-based measure of functional status. 0 = no reported dysfunction; 100 = severe dysfunction.	Same questions as SIP (see below), except in addition, each time a patient responds positively to a statement contained in the SIP, they are asked whether they think the statement applies because of their vision.

Generic measures – Quality of Life

The following measurement tools were developed to be used “generically” across different medical conditions.

Tool	Worst – Best	Description	Details - Subscales
SF-36 [5]	0 – 100	<u>Short Form - 36</u> 36 items, 8 subscales used to measure quality of life across different health conditions. Each subscale is scored 0-100 0 = worse possible score; 100 = best possible score.	Physical functioning, role limitations caused by physical health problems, bodily pain, general health, vitality (energy/fatigue), social functioning, role limitations caused by emotional problems, and mental health (psychological distress and psychological well-being).
Sickness Impact Profile (SIP) [15, 27]	100 - 0	<u>Sickness Impact Profile</u> 136 items measuring functional status and quality of life in general. 0 = no reported dysfunction; 100 = severe dysfunction.	Patients are asked which of 136 statements describes them (e.g. “I am doing fewer social activities with groups of people”).
QOL Nepal 1999 / [44]	0 - 100	<u>Quality of Life (Nepal)</u> 12 item scale containing four subscales. Items equally weighted within subscales. 0 = worst health; 100 = best health.	Subscales: Self care (bathing, eating, dressing, toileting), Mobility (walking to neighbours, walking to shops, doing household chores), Social interaction (attending functions, meeting friends), and Mental wellbeing (burden on others, dejection, loss of confidence).

Cataract Surgery Literature Review Appendix E: Measurement Data

The following data was abstracted from the raw scores presented in the references cited. See below for key to methods ID. Dark grey rows indicate the standardised score, recalculated on a 0 – 100 (Worst - Best) scale.

Measure [Worst - Best]	Value	Method ID	Preop	2 mo.	4 mo.	6 mo.	1 yr.	Change	n=	Reference
ADVS [0 - 100]	Mean (range)	5	78 (62 - 95)						426	[22]
ADVS [0 - 100]	Mean	13	62.9				85.3	22.4	49	[23]
ADVS [0 - 100]	Mean	7	67.2				83.1	15.9	224	[23]
ADVS [0 - 100]	Mean	14	72.1				86.8	14.7	168	[23]
ADVS [0 - 100]	Mean (SD)	5	67 (22)						334	[29]
ADVS Day driving [0 - 100]	Mean (SD)	5	68 (29)						334	[29]
ADVS Distance vision [0 - 100]	Mean (SD)	5	68 (24)						334	[29]
ADVS Glare [0 - 100]	Mean (SD)	5	66 (33)						334	[29]
ADVS Near Vision [0 - 100]	Mean (SD)	5	72 (24)						334	[29]
ADVS Nite driving [0 - 100]	Mean (SD)	5	44 (31)						334	[29]
Age	Mean	1	> 75						337	[21]
Age	Mean	2	72 +/- 8						552	[19, 27, 32]
Age	Mean	4	73						243	[28]
Age	Mean	5	71.8						426	[28]
Age	Mean	5	75 +/- 9						334	[29]
Age	Mean	6	73.8						127	[2]
Age	Mean	5	73 +/- 9						93	[31]

Measure [Worst - Best]	Value	Method ID	Preop	2 mo.	4 mo.	6 mo.	1 yr.	Change	n=	Reference
Age	Mean	4	70						776	[9]
Age	Mean	13	76						464	[23]
Age	Range	7	71-76						100	[43]
Age	Mean (SD)	3	74 +/- 8						47	[25]
Age Barcelona	Mean	2	69.9						200	[41]
Age Denmark	Mean	2	73.5						291	[41]
Age Manitoba	Mean	2	73.5						152	[41]
Age USA	Mean	2	72.4						766	[41]
Combined distance/near [1 - 3]	Mean (range)	3	2.21 +/- 0.46				2.61 +/- 0.46	0.4	178	[20]
[0 - 100] [∇]			[73.6 +/- 15.3]				87 +/- 15.3	13.4		
Combined distance/near [1 - 3]	Mean (range)	8	2.43 +/- 0.45				2.83 +/- 0.28	0.4	138	[20]
[0 - 100] [∇]			81 +/- 15				94.3 +/- 9.3	13.3		
Combined distance/near [1 - 3]	Mean (range)	9	2.21 +/- 0.50				2.81 +/- 0.35	0.6	49	[20]
[0 - 100] [∇]			73.6 +/- 16.6				93.6 +/- 11.6	20		
Combined distance/near [1 - 3]	Mean (range)	11	2.74 +/- 0.42				2.74 +/- 0.39	0	362	[20]
[0 - 100] [∇]			91.3 +/- 14				91.3 +/- 13	0		
Combined distance/near [1 - 3]	Mean (range)	7	2.14 +/- 0.51				2.47 +/- 0.54	0.33	79	[20]
[0 - 100] [∇]			71.3 +/- 17				82.3 +/- 18	11		

Measure [Worst - Best]	Value	Method ID	Preop	2 mo.	4 mo.	6 mo.	1 yr.	Change	n=	Reference
Combined distance/near [1 - 3]	Mean (range)	4	2.15 +/- 0.53				2.63 +/- 0.53	0.48	14	[20]
[0 - 100] [∇]			71.6 +/- 11.6				87.6 +/- 17.6	16		
Combined distance/near [1 - 3]	Mean (range)	5	2.27 +/- 0.54				2.62 +/- 0.54	0.35	26	[20]
[0 - 100] [∇]			75.6 +/- 18				87.3 +/- 18	11.7		
Combined distance/near [1 - 3]	Mean (range)	10	2.73 +/- 0.42				2.74 +/- 0.42	0	363	[20]
[0 - 100] [∇]			91 +/- 14				91.3 +/- 14	0.3		
CSS [15 - 0]	Mean (SD)	2	5.2 (3.7)		0.8*			-4.4 +/- 4.0	552	[27]
[0 - 100] [∇]			65.4		94.7		29.3			
CSS [15 - 0]	Mean (SD)	4	5.6 (4.0)						243	[28]
[0 - 100] [∇]			62.7							
CSS [15 - 0]	Mean (SD)	5	5.0 (3.4)						426	[28]
[0 - 100] [∇]			66.7							
CSS [15 - 0]	Mean (SD)	2	5.6 (4.1)		0.8 (1.9)			-4.8	552	[19]
[0 - 100] [∇]			62.7		94.7			32		
CSS (CAN) overall [3 - 0]	Mean (SD)	5	0.91 (0.54)				0.33 (0.34)	-0.61 (0.58)	92	[10]
[0 - 100] [∇]			69.7				89	19.33		
CSS (CAN) glare [3 - 0]	Mean (SD)	5	1.59				0.84	-0.85	92	[10]
[0 - 100] [∇]			47				72	25		

Measure [Worst - Best]	Value	Method ID	Preop	2 mo.	4 mo.	6 mo.	1 yr.	Change	n=	Reference
CSS (CAN) blurry vision [3 - 0] [0 - 100] [∇]	Mean (SD)	5	1.55 48.4				0.52 82.7	-1.07 34.3	92	[10]
CSS (CAN) halo [3 - 0] [0 - 100] [∇]	Mean (SD)	5	0.61 79.7				0.17 94.4	0.48 14.7	92	[10]
CSS (CAN) double vision [3 - 0] [0 - 100] [∇]	Mean (SD)	5	0.49 83.7				0.32 89.3	0.17 5.6	92	[10]
Global Vision [0 - 100]	Mean (SD)	5	61 (23)						334	[29]
NEI-VFQ Color vision [0 - 100]	Mean (SD)	5	90 +/- 20						93	[31]
NEI-VFQ Dependency [0 - 100]	Mean (SD)	5	88 +/- 19						93	[31]
NEI-VFQ Distance vision [0 - 100]	Mean (SD)	5	79 +/- 18						93	[31]
NEI-VFQ Driving [0 - 100]	Mean (SD)	5	74 +/- 17						93	[31]
NEI-VFQ Expectations [0 - 100]	Mean (SD)	5	66 +/- 21						93	[31]
NEI-VFQ General health [0 - 100]	Mean (SD)	5	64 +/- 20						93	[31]

Measure [Worst - Best]	Value	Method ID	Preop	2 mo.	4 mo.	6 mo.	1 yr.	Change	n=	Reference
NEI-VFQ General vision [0 - 100]	Mean (SD)	5	61 +/- 16						93	[31]
NEI-VFQ Mental Health [0 - 100]	Mean (SD)	5	77 +/- 17						93	[31]
NEI-VFQ Near vision [0 - 100]	Mean (SD)	5	74 +/- 20						93	[31]
NEI-VFQ Social Functioning [0 - 100]	Mean (SD)	5	91 +/- 14						93	[31]
NEI-VFQ Ocular pain (?despite being painless) [0 - 100]	Mean (SD)	5	86 +/- 19						93	[31]
NEI-VFQ Peripheral vision [0 - 100]	Mean (SD)	5	87 +/- 21						93	[31]
NEI-VFQ Vision specific role difficultites [0 - 100]	Mean (SD)	5	80 +/- 19						93	[31]
Ocular comorbidities	%	2	35%						552	[19, 27, 32]
Ocular comorbidities	%	4	30%						243	[28]
Ocular comorbidities	%	5	35%						426	[28]
Ocular comorbidities	%	7	25%						362	[20]
Ocular comorbidities	%	5	60%						93	[31]

Measure [Worst - Best]	Value	Method ID	Preop	2 mo.	4 mo.	6 mo.	1 yr.	Change	n=	Reference
Ocular comorbidities	%	5	85.70%						92	[10]
Ocular comorbidities	%	13	50%						464	[23]
Ocular comorbidities	%	12	36%						1933	[46]
Ocular comorbidities Barcelona	%	2	56.8						200	[41]
Ocular comorbidities Denmark	%	2	35.8						291	[41]
Ocular comorbidities Manitoba	%	2	38.1						152	[41]
Ocular comorbidities USA	%	2	36.3						766	[41]
Satisfaction with vision [Descriptive]	Highest %	2	90.4% Dissatisfied / Very Dissatisfied					-1.4 +/- 0.9‡	551	[27]
Satisfaction with vision Barcelona [Descriptive]	Highest %	2	88% Dissatisfied / Very Dissatisfied		81% Very Satisfied / Satisfied				218	[24]
Satisfaction with vision [Descriptive]	Highest %	2	88.% Dissatisfied / Very Dissatisfied		88.1 Very Satisfied / Satisfied				552	[19]

Measure [Worst - Best]	Value	Method ID	Preop	2 mo.	4 mo.	6 mo.	1 yr.	Change	n=	Reference
Satisfaction with vision [Descriptive]	Highest %	4	91% Dissatisfied / Very Dissatisfied						243	[28]
Satisfaction with vision [Descriptive]	Highest %	5	88.3% Dissatisfied / Very Dissatisfied						426	[28]
SF-36 Role limits physical [0 - 100]	Mean (SD)	10	52.97 (40.78)						1642	[5]
SF-36 Role limits physical [0 - 100]	Mean	11	68.3						1642	[5]
SF-36 Emotional well being [0 - 100]	Mean (SD)	10	70.38 (21.97)						1642	[5]
SF-36 Emotional well being [0 - 100]	Mean	11	82.2						1642	[5]
SF-36 Energy/fatigue [0 - 100]	Mean (SD)	10	52.15 (22.39)						1642	[5]
SF-36 Energy/fatigue [0 - 100]	Mean	11	61.9						1642	[5]
SF-36 General Health [0 - 100]	Mean (SD)	10	56.99 (21.11)						1642	[5]
SF-36 General Health [0 - 100]	Mean	11	67.6						1642	[5]

Measure [Worst - Best]	Value	Method ID	Preop	2 mo.	4 mo.	6 mo.	1 yr.	Change	n=	Reference
SF-36 Pain [0 - 100]	Mean (SD)	10	70.77 (25.46)						1642	[5]
SF-36 Pain [0 - 100]	Mean	11	81.7						1642	[5]
SF-36 Physical Functioning [0 - 100]	Mean (SD)	10	70.61 (27.42)						1642	[5]
SF-36 Physical Functioning [0 - 100]	Mean	11	82.8						1642	[5]
SF-36 Role limits emotional [0 - 100]	Mean (SD)	10	65.78 (40.71)						1642	[5]
SF-36 Role limits emotional [0 - 100]	Mean	11	83						1642	[5]
SF-36 Social functioning [0 - 100]	Mean	11	86.3						1642	[5]
SIP [100 - 0] [0 - 100]	Mean (range)	1	12 (10.8-13.3) 88		9 91		8.1 91.9	-3 3	213	[21]
SIP [100 - 0] [0 - 100] [∇]	Mean (SD)	2	7.5 (9.3) 92.5		5.4* 94.6			-2.1 2.1	552	[27]
SIP [100 - 0] [0 - 100] [∇]	Mean	3	7.9 92.1						717	[15]
SIP Barcelona [100 - 0] [0 - 100] [*]	Mean (SD)	2	15 (13) 85		11.1 88.9			-3.9 3.9	218	[24]

Measure [Worst - Best]	Value	Method ID	Preop	2 mo.	4 mo.	6 mo.	1 yr.	Change	n=	Reference
SIP Barcelona [100 - 0]	Mean (SD)	2	14.6 (13)						200	[41]
[0 - 100] [∇]			85.4							
SIP Denmark [100 - 0]	Mean (SD)	2	6.3 (7.0)						291	[41]
[0 - 100] [∇]			93.7							
SIP Manitoba [100 - 0]	Mean (SD)	2	8.9 (9.6)						152	[41]
[0 - 100] [∇]			91.1							
SIP USA [100 - 0]	Mean (SD)	3	8.3 (10)						766	[41]
[0 - 100] [∇]			91.7							
Trouble with vision [Descriptive]	Highest %	2	79.4% Moderate amount / Great deal					-1.3 +/- 1.1 [‡]	552	[27]
Trouble with vision [Descriptive]	Highest %	2	83% Moderate amount / Great deal		70% Not difficult/ little difficult				218	[24]
Trouble with vision [Descriptive]	Highest %	4	84% Moderate amount / Great deal						243	[28]
Trouble with vision [Descriptive]	Highest %	5	76.2% Moderate amount / Great deal						426	[28]
VA	Highest %	1	6/18-6/24						273	[21]
VA	Mean	2	0.1		0.6 ^{‡‡}				218	[24]
VA	Mean	2	20/60		20/25				552	[19, 27, 32]

Measure [Worst - Best]	Value	Method ID	Preop	2 mo.	4 mo.	6 mo.	1 yr.	Change	n=	Reference
VA	Mean (range)	3	20/80 (20/20 - LP)	20/25 (20/15-20/400)					155	[20]
VA	Mean (range)	7	20/100 (20/25 - CF)	20/40 (20/20-CF)					72	[20]
VA	Mean	8	20/70	20/25					121	[20]
VA	Mean	4	20/70	20/40					14	[20]
VA	Mean	9	20/40	20/20					37	[20]
VA	Mean	5	20/50	20/25					15	[20]
VA	Mean	6	20/28						127	[2]
VA	Mean	4	20/40						776	[9]
VA	Mean (range)	5	20/70 (20/50 - 20/200)				20/40		426	[22]
VA	% Functional central vision loss	5	29 +/- 19%						334	[29]
VA	Average	5	20/70 (20/25 - 20/2000)				20/25 - 20/30		92	[10]
VA	Mean logMAR (Snellen equiv)	12	0.80 (6/38)		0.36 (6/12)				92/98	[18]
VA	Median log MAR (Snellen equiv)	12	0.78 (6/36)		0.30 (6/12)				92/98	[18]
VA	Mean	13	20/70				20/40 (80%)		464	[23]
VA	Mean (range)	3	20/70 (20/20 - HM)						47	[25]

Measure [Worst - Best]	Value	Method ID	Preop	2 mo.	4 mo.	6 mo.	1 yr.	Change	n=	Reference
VA	Mean (SD)	9	20/40 (20/20 - 20/28)						234	[1]
VA BCVA in Sloan chart	Mean (SD)	3	0.54 +/- 0.12 (27 letters)		0.95 +/- 0.15 (47.5 letters)				50	[26]
VF-12 [0 - 100]	Mean (SD)	7	80.2 (16.1)						552	[17]
VF-12 Age >/ 75 [0 - 100]	Mean	7	78.8		93.6			14.8	220	[17]
VF-12 Age 50+ [0 - 100]	Mean (SD)	7	77.6 (1.5)		93.0 (0.9)			15.4	133	[17]
VF-12 Age 50- 64 [0 - 100]	Mean	7	79.4		96.3			16.9	82	[17]
VF-12 Age 65 – 74 [0 - 100]	Mean	7	81.8		96.6			14.8	250	[17]
VF-14 [0 - 100]	Mean (range)	1	68.7 (66.2-71.1)		88.5		99.1	19.8	316	[21]
VF-14 [0 - 100]	Mean (SD)	2	76.5 (16.3)		93.2 (9.4)			16.7 (15.9)	552	[19, 27, 32]
VF-14 [0 - 100]	Mean (range)	3	75.5 (12.5-100)						717	[15]
VF-14 [0 - 100]	Mean (SD)	4	73 (15.8)						243	[28]
VF-14 [0 - 100]	Mean (SD)	5	77.6 (16.3)						426	[28]
VF-14 Barcelona [0 - 100]	Mean (SD)	2	64 (27)		85.7			21.7	218	[24]
VF-14 Barcelona [0 - 100]	Mean (SD)	2	64 (27)						200	[41]

Measure [Worst - Best]	Value	Method ID	Preop	2 mo.	4 mo.	6 mo.	1 yr.	Change	n=	Reference
VF-14 Denmark [0 - 100]	Mean (SD)	2	76 (17)						291	[41]
VF-14 Manitoba [0 - 100]	Mean (SD)	2	71 (21)						152	[41]
VF-14 USA [0 - 100]	Mean (SD)	2	76 (17)						766	[41]
VF-14 Overall [4 - 0]	Mean	5	0.897				0.358	-0.539	92	[10]
[0 - 100] [∇]			77.6				91.1	13.5		
VF-14 Fine handwork [4 - 0]	Mean (SD)	5	1.81 (1.60)				0.84 (1.45)	0.85	92	[10]
[0 - 100] [∇]			54.8				79	24.2		
VF-14 Reading newspaper or book [4 - 0]	Mean (SD)	5	1.48 (1.35)				0.66 (1.15)	0.82	92	[10]
[0 - 100] [∇]			63				83.5	20.5		
VF-14 Reading small print [4 - 0]	Mean (SD)	5	2.2				1.33 (1.44)	0.97	92	[10]
[0 - 100] [∇]			45				66.8	21.8		
VF-14 Traffic signs [4 - 0]	Mean (SD)	5	0.87 (1.34)				.32 (.88)	0.58	92	[10]
[0 - 100] [∇]			78.3				92	13.7		
VF-14 Watching television [4 - 0]	Mean (SD)	5	0.73 (1.06)				0.18 (0.56)	0.5	92	[10]
[0 - 100] [∇]			81.75				95.5	13.8		

Measure [Worst - Best]	Value	Method ID	Preop	2 mo.	4 mo.	6 mo.	1 yr.	Change	n=	Reference
VF-14 Driving daytime [4 - 0]	Mean (SD)	5	0.37 (0.75)				0.08 (0.34)	0.3 (0.81)	92	[10]
[0 - 100] [∇]			90.8				98	7.2		
VF-14 Driving night [4 - 0]	Mean (SD)	5	1.46 (1.36)				0.27 (0.67)	0.74 (1.21)	92	[10]
[0 - 100] [∇]			63.5				93.3	29.8		
VF-14 Seeing steps, curbs, stairs [4 - 0]	Mean (SD)	5	0.51 (0.89)				0.35 (0.78)	0.22 (1.01)	92	[10]
[0 - 100] [∇]			81.75				95.5	13.8		
Visual Function Tobacman ADL [100 - 0]	% impair- ment	4	40%						776	[9]
Visual Function Tobacman Driving [100 - 0]	% impair- ment	4	44%						776	[9]
Visual Function Tobacman Employment [100 - 0]	% impair- ment	4	7%						776	[9]
Visual Function Tobacman Glare associated [100 - 0]	% impair- ment	4	28%						776	[9]
Visual Function Tobacman Recreation [100 - 0]	% impair- ment	4	73%						776	[9]
VR-SIP [100 - 0]	Mean (range)	1	1.6 (1.2-2)		0.3		0.2	-1.3 - -1.4	213	[21]
[0 - 100] [∇]			98.4		99.7		99.8	1.3 - 1.4		

Measure [Worst - Best]	Value	Method ID	Preop	2 mo.	4 mo.	6 mo.	1 yr.	Change	n=	Reference
VR-SIP Barcelona [100 - 0]	Mean (SD)	2	5 (8)		1.3			-3.7	218	[24]
[0 - 100] [∇]			95		98.7			3.7		
VR-SIP [100 - 0]	Mean (SD)	2	1.6 (4.2)						552	[27]
[0 - 100] [∇]			98.4							
VR-SIP [100 - 0]	Mean	3	1.6						717	[15]
[0 - 100] [∇]			98.4							

*Calculated from raw “benefit” score, eg article reports only the change and not the postoperative score.

‡ A mean change of -1 in the study data indicates an improvement of one category.

‡‡ Study number postoperative 157 (less than preoperative study number)

[0 - 100][∇] Values in the dark grey row indicate the recalculated score, standardised onto a 0 - 100 (Worst - Best) scale.

Inclusion/Exclusion:

- Control groups (no cataracts or no ocular condition): 10, 11
- 1st eye only: 2, 3, 7
- 2nd eye only: 4, 8, 14
- Bilateral (Both) within year followup, or mix 1st and 2nd: 1, 5, 9, 12, 13
- Without ocular comorbidities: 3, 6, 8, 9, 11
- With ocular comorbidities: 2, 4, 5, 7, 10, 12, 13, 14, 1
- Age-Related Macular degeneration study: 12

Method ID	1 st eye only	1 st & 2 nd eye	2 nd eye only	Control group	No combined ocular procedure	No significant ocular commorbidities	Ocular comorbidities included	Other
1		X			X			
2	X				X		X	
3	X				X	X		
4			X		X		X	
5		X			X		X	
6						X		*contrast
7	X						X	
8			X			X		
9		X				X		
10				X			X	
11				X		X		
12		X					X	ARM
13		X					X	
14			X				X	

Cataract Surgery Literature Review Appendix F: Outcomes Expressed as “Improvement”

Studies that report improvement in text rather than raw scores are documented in the following table. All data reflects both first and second eye extractions, unless otherwise noted in column marked “variable”. Data from measures with an asterisk* reflect no presence of other ocular pathology in the study population.

Inclusion	Measure	Improvement	n=	Reference
	ADVS	80% improvement	224	[23]
	ADVS	39% had substantial improvement, 20% had some improvement, 41% had minimal or no improvement.	426	[22]
	Cataract Symptoms	46.4% - 70% improvement*	234	[1]
	CSS	75.1% improvement	219	[36]
	Driving	40% increase in number of patients who regained driving skill	127	[2]
First eye	Reading	79% improvement	100	[43]
	Satisfaction	24% improvement in patients with both eyes compared to first eyes	243	[28]
First eye	Satisfaction	62% of patients judged their vision to be greatly improved*	50	[26]
	Satisfaction	80.10% improvement	219	[36]
	SF-36	36% improvement	224	[23]
	SF-36	Average scores on seven of 8 subscales of the SF-36 worsened at one year	224	[23]
	SIP	Significant improvement	998	[21]
	Trouble	75% - 80% improvement	219	[36]
	Trouble	27% improvement in patients with both eyes compared to first eyes	243	[28]
First eye	VA	55% increase in number of persons with “very good or normal vision”	100	[43]
	VA	3.3 (0.0 to 7.8 lines)*	234	[1]
	VA	95%	224	[23]

Inclusion	Measure	Improvement	n=	Reference
	VA	95% improvement	219	[36]
	VA	80% improved to 20/40 or better	426	[22]
	VF-14	61% improvement in patients with both eyes compared to first eyes	243	[28]
	VF-14	Significant improvement	337	[21]
	VF-14	89.40% improvement	219	[36]
First eye	VF-14 - Cooking	20.2% improvement, and 77.2% no change*	142	[16]
First eye	VF-14 - Fine handwork	71.80% improvement*	142	[16]
First eye	VF-14 - night driving	64.10% improvement*	142	[16]
First eye	VF-14 - Reading small print	73.90% improvement*	142	[16]
First eye	VF-14 - Reading traffic signs	41.20% improvement*	142	[16]
First eye	VF-14 - Seeing steps	51.40% improvement*	142	[16]
First eye	VF-14 - Watching television	53.90% improvement*	142	[16]
	Visual Function	73% improvement	1021	[20]
First eye	Visual Function	75% - 76% improvement	1021	[20]
	Visual Function	92%* improvement	1021	[20]
First eye	Visual Function	72% - 86% improvement	1021	[20]
	Visual Function	80% improvement	764	[35]
	Visual Function	90% improvement*	764	[35]
	VR-SIP	Significant improvement	337	[21]

*Data does not reflect presence of other ocular pathology in the study population

Cataract Surgery Literature Review Appendix G: Summary of Prognostic Indicators

Measure	Statement [Reference]
Visual Acuity	<ul style="list-style-type: none"> • Underestimate overall benefit[21] • No correlation between preoperative visual acuity and overall benefit.[2, 19, 23, 24] • Preoperative visual acuity was greatest predictor of postoperative visual acuity in dataset that contained high percentage of coexistent ocular pathology (85.7%).[10] • Preoperative VA does not predict improvement in patients with disability glare.[3]
Visual function as defined as VA, VF-14, and CS-5	Patients with worse visual function (as measured by VA, VF-14, CS-5) were more likely to have a greater change in their outcome measure.[24]
Visual acuity, or age, or comorbidities	Greater age, poorer baseline visual acuity, or presence of glaucoma, age-related macular degeneration, and diabetes-mellitus-related conditions resulted in poorer postoperative visual acuity.[33]
Contrast sensitivity and Visual acuity	Greater degree of preoperative impairment in objective visual function as measured by VA and contrast sensitivity, the greater postoperative improvement in subjective visual function (questionnaire scores).[1]
Age	<p>People aged 75 or greater have increased risk of failing to improve on one or more outcome measures.[19]</p> <p>People aged 50-64 achieved greatest gain in VF-14.[17]</p> <p>Patients aged 75 or less show the greatest benefit.[22]</p>
Generic measures of quality of life	<p>SIP does not capture improvements in functioning.[32]</p> <p>Patients with better preoperative scores have higher improvement.[24]</p> <p>SF-36 not sensitive enough to be used as a prognostic indicator.[22]</p> <p>Seven of eight subscales of the SF-36 worsened at one year after cataract extraction despite improvement being demonstrated with the ADVS. [22]</p> <p>VR-SIP less sensitive to functional impairment related to vision than the VF-14. [32]</p>

Measure	Statement [Reference]
VF-14	<p>VF-14 strongest predictor of change in self-reported satisfaction and trouble with vision.[15, 27, 36]</p> <p>Score of 90 or higher was associated with an increased likelihood of a failure to improve on one or more measures (odds ration 2.10). Associated with a 20-5% - 26.5% greater likelihood of failure to benefit.[19]</p> <p>“Worse VF-14” associated with higher level of improvement.[24]</p>
VF-7	Strong predictor of change in patient satisfaction.[16]
ADVS	Poor ADVS preoperative score significantly correlated with improvement.[22]
Visual function (eg ADVS, VF-14)	Strongest predictor of visual outcome and QOL independent of visual acuity.[8, 19, 23]
CSS	<p>CSS score of 3 or less was associated with increased likelihood of not improving on one or more measures (odds ratio 3.29). [19]</p> <p>Increased severity of coexisting ocular pathology associated with increasing risk of poor visual acuity.[35]</p>
Ocular comorbidity	<p>Patients with no ocular comorbidity were more likely to have greatest subjective improvement.[Javitt, 1993 #112;[24, 33, 35]</p> <p>Presence of ocular comorbidities were associated with a 20.5% - 26.5% greater likelihood of failure to benefit.[19]</p> <p>Ocular comorbidity was associated with higher incidence of postoperative complications.[36]</p> <p>Presence of posterior subcapsular cataract, and the absence of age-related macular degeneration and/or diabetes were predictors of improvement.[22]</p>
Previous cataract removal (second eyes)	<p>Patients having second eye extraction had the greatest improvement in postoperative visual acuity.[10]</p> <p>Outcome better if second eye done soon after the first procedure, rather than later.[37]</p> <p>Improvement associated with second eye surgery was greatest in older patients.[28]</p>

Cataract Surgery Literature Review Appendix H:
New Zealand Cataract Priority Criteria[11]
 Draft Cataract Surgery Priority Criteria

September 30, 1999

Maximum score is 100.

Clinical features							Score
Visual acuity	6/9 or better	6/12	6/18	6/24	6/36	6/60	Count fingers/hand movements
6/9 or better	0	1	2	3	4	5	6
6/12		7	8	9	10	11	12
6/18			14	15	16	17	18
6/24				21	22	23	24
6/36					28	29	30
6/60						35	36
Count fingers/hand movements							40
Glare							
None							0
Mild-moderate							5
Severe							10
Ocular comorbidity (e.g. age-related macular degeneration, chronic simple glaucoma)							
None							0
Mild-moderate							5
Severe							10
Ability to work, care for dependants, or work independently							
Not threatened or not applicable							0
Not threatened but more difficult							2
Threatened but not immediately							6
Immediately threatened							15
Extent of impairment in visual function (e.g. reading, recognizing faces, seeing steps or curbs, watching TV, driving, and reading traffic signs)							
None							0
Mild							5
Moderate							10
Severe							20
Other substantial disability (e.g. hearing loss, uses wheelchair)							
No							0
Yes							5
Total Score							

