TITLE: Interventions Used to Determine the Appropriate Patient Populations for Cataract Surgery: A Review of the Clinical Evidence and Guidelines

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CONTEXT AND POLICY ISSUES

Cataracts are the leading cause of blindness in the world,[1] and more than 1.3 million Canadians reported being diagnosed with a cataract in 2008-09.[2] Cataracts are highly treatable surgically, with minimal complications.[1,3] More than a quarter million patients undergo cataract surgery in Canada annually.[4]

Extended wait times for elective procedures has been an important issue in the Canadian health care system for many years, and sight restoration was among the five priority clinical areas identified and targeted for wait time reduction by the Canadian first ministers in 2004.[5] The extent to which this initiative has been successful for cataract surgery is unclear. According to a recent report from the Canadian Institute for Health Information,[6] while there was a six-percent increase in the number of cataract procedures performed in Canada between 2010 and 2012, the proportion of patients receiving their surgeries within the 16-week benchmark wait time increased by only one percent. The report suggested that increased surgical volumes are not resulting in better wait times because demand is rising at a rate that exceeds the health care system's ability to meet the needs of the population.

While 83% of patients receive their cataract surgery within the benchmark timeframe at the national level, there is significant inter-provincial variation in accessibility and in some provinces, this proportion is as low as 48%.[7] The implications of delayed cataract surgery, particularly for more severe cases, are significant and include vision loss, depression, an increased risk of falls and injury, and decreased quality of life.[3,8]

One approach for improving accessibility to cataract surgery is to better identify patients that are most likely to benefit from this procedure, thus limiting inefficient use of scarce resources, and providing better access and care to patients who are most in need in a timely manner. The

objectives of the present review are to research and summarize the evidence for interventions that are used to restrict or minimize the use of cataract surgery and to identify those patients who are likely to benefit from this procedure, and to research and summarize the guidelines for patient selection for cataract surgery.

RESEARCH QUESTIONS

1. What is the clinical evidence regarding interventions to restrict or minimize the use of cataract surgery to identify the appropriate patients who will benefit from cataract surgery?

2. What are the evidence-based guidelines for selecting appropriate candidates for cataract surgery?

KEY FINDINGS

The findings of eight observational validation studies suggest that there are some tools available that may help to predict and select which candidates are likely to most benefit from cataract surgery. However, none of these studies was of a comparative intervention and so some question remains regarding the practical prospective application of these tools in an actual clinical setting, and the comparative effectiveness of using these tools versus other tools or standard practice. Current guidelines provide guidance for evaluating patients for cataract surgery, but do not provide specific metrics for determining appropriateness or prioritizing patients' requirements for this procedure.

METHODS

Literature Search Strategy

A limited literature search was conducted on key resources including PubMed, The Cochrane Library (2013, Issue 2), University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. Methodological filters were applied to limit retrieval to health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies and guidelines. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2006 and March 13, 2013. A previously published CADTH report on interventions used to determine appropriate patient populations for cataract surgery[9] was also hand-searched for relevant papers that may not have been identified through the literature search strategy.

Selection Criteria and Methods

The citations identified by this literature search were screened according to the selection criteria provided in Table 1. One reviewer screened the titles and abstracts of the retrieved publications and evaluated the full-text publications of the final article selection.

Table 1: Selection Criteria

Population	Patients eligible for cataract surgery
Intervention	Any intervention to reduce inappropriate surgery (e.g. screening tools, funding policies, clinical guidelines)
Comparator	No intervention to reduce inappropriate surgery
Outcomes	Q1: increase in the proportion of patients with better vision; decrease in the proportion of individuals with no difference in their vision; decrease in the patients with worse vision; clinical benefits; clinical harms. Q2: guideline recommendations for selecting appropriate candidates for cataract surgery
Study Designs	Health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies, guidelines

Exclusion Criteria

Articles were excluded if they did not fulfill the study selection criteria described in Table 1, and in the case of guidelines, if they were not evidence based.

Critical Appraisal of Individual Studies

The AMSTAR tool[10] was used to assess the methodological quality of included systematic reviews, the Downs and Black[11] instrument was used to evaluate observational studies, and the AGREE II instrument[12] was used to evaluate guidelines. A numeric score was not calculated; instead each report's fulfillment of the relevant criteria was described and summarized.

SUMMARY OF EVIDENCE

Quantity of Research Available

The literature search yielded 482 citations. The abstracts for these reports were reviewed and twenty studies were selected for further screening. An additional five references were identified from the grey literature and two were found through hand-searching selected reports. A total of twelve reports were selected for inclusion. A description of the screening results is provided in Appendix 1. Of the 12 selected reports, one[13] was a systematic review, eight[14-21] were observational studies, and three[4,22,23] were guidelines. No randomized controlled trials were identified. Five of the excluded reports described the development and validation of tools for identifying patients for cataract surgery, however these reports did not include an assessment of impact on clinical outcomes. Of note, many of these tools were evaluated in the observational studies identified and described for this report. The five excluded reports have been listed in Appendix 2 for the reader's interest.

Two studies[24,25] that had been included in an earlier CADTH report on this topic[9] did not meet the inclusion criteria of the present report upon full text review. One of these studies[24] is included in Appendix 2.

Summary of Study Characteristics

A summary of the characteristics of the studies included in this report is provided in Table A.1 of Appendix 4.

The systematic review by Keay et al.[13] looked at the evidence for routine preoperative medical testing and investigated reductions in related adverse events. The literature search considered randomized controlled trials that compared preoperative testing to detect co-morbid conditions with no preoperative testing, prior to age-related cataract surgery. The assumption of pre-operative testing is that detection of certain comorbidities would identify patients that could not undergo cataract surgery safely. No date or language restriction was placed on the search which included literature published up to December 2011. Study quality was evaluated using the Cochrane Risk of Bias tool. The primary outcome of the meta-analysis performed in this systematic review was the rate of medical adverse events which occurred within seven days of surgery. A secondary outcome was ocular adverse events, as reported. The authors identified three randomized trials [Cavallini (2004, Italy); Lira (2001, Brazil); Schein (2000, USA and Canada)]. The combined sample size of the three trials was 21,858 patients. Risk of bias in the three studies was considered low in general, however physicians and participants were not masked in two of the trials (Lira, Schein).

Las Hayas et al.[14] conducted a prospective observational cohort study that sought to determine whether the IRYSS-appropriateness of indication for cataract surgery tool could also be used to prioritize patients on cataract extraction waiting lists. The IRYSS appropriateness of indication tool was developed using focus groups and the RAND/UCLA appropriateness method (RAM) that considered 765 clinical scenarios that were classified into one of four levels (necessary, appropriate, uncertain, inappropriate). The variables that establish a judgment of appropriateness include: ocular comorbidities, pre-intervention best corrected visual acuity (BCVA) in the eye with the cataract and in the contralateral eye, surgical complexity of the cataract extraction, laterality of cataract, anticipated visual acuity after extraction, and visual function. Information was obtained from 5,448 consecutive patients undergoing cataract surgery between October 2004 and July 2005 in clinics in Spain were used, and patients were evaluated prospectively three months post-surgery. IRYSS-appropriateness scores were correlated with IRYSS-cataract priory scores, visual acuity scores, and visual function scores.

Las Hayas et al. also published a report on assessing two other priority systems to be potentially used as appropriateness of indication tools for cataract surgery.[20] The authors conducted a cross-sectional study with follow-up at 6 weeks and at 3 months in 1,723 patients awaiting cataract surgery by phacoemulsification between October 2004 and July 2005 in Spain. The two tools evaluated were the Western Canadian Waiting List (WCWL) and the Catalan Agency for Health Technology Assessment and Research Cataract Priority System (CCPS). The WCWL was developed by a panel of experts based on literature review and has seven criteria for prioritizing patients: the visual acuity in the eye that underwent surgery, the visual acuity in the eye that did not undergo surgery, glare, ocular comorbidity, degree of impaired visual function, other substantial disability, and the ability to live or work independently or care for dependents. The CCPS was developed from focus groups and consists of six prioritization criteria: visual impairment, limitations in activities of daily living due to cataract, probability of restoration, work limitation due to cataract, availability of a caregiver, and the need to care for others. The authors compared these tools with visual acuity and VF-14 scores before and after surgery, and the sensitivity of the two priority systems was evaluated using the IRYSS-Cataract Appropriateness score.

Kuoppala et al.[15] conducted a prospective observational study with the objective of defining preoperative criteria for successful cataract surgery based on predictive factors. The tools they considered were the visual acuity test, the VF-14 (visual function), the 15D HRQOL Questionnaire, and the New Zealand Priority Criteria. Ninety-three consecutive patients who underwent cataract surgery in Finland 2003 were followed nine months post-surgery. A *post hoc* evaluation of criteria for surgery using logistic regression was performed, and the outcomes of interest were odds of diagnostic success and odds of treatment success given the scores in each of the tools considered, as well as with physician opinion.

Quintana et al[21] developed decision trees based on prospectively collected data to determine the appropriateness of cataract extraction. This prospective observational study conducted in Spain included 3,691 patients in derivation cohort and 2,416 patients in validation cohort, all waiting for cataract surgery by phacoemulsification between October 2004 and July 2005. The authors constructed two decision trees – one for simple cataract and one for cataract with other ocular comorbidities. Patients were followed up at 6 weeks and at 3 months. The authors used multivariate linear regression for the decision tree analysis, and compared differences in proportions and means between groups at follow up. The authors also compared the results of the decision trees to benchmark definitions of appropriateness that were derived based on pre- and expected post-intervention values of visual acuity, visual function and clinical expert opinion. Sensitivity, specificity, and area under the curve (or AUC – a measure of the accuracy of a test that plots the true positive versus the false positive, with a range of 0 to 1 and for which values >0.5 indicate a test that performs better than random) were estimated.

Quintana et al.[16] validated appropriateness criteria for cataract surgery using data on 4,335 patients in a prospective observational cohort study. Patients were seen in clinics in Spain between October 2004 and July 2005, and were followed at three months post-surgery. In this study, the authors developed an appropriateness tool based on the RAND/UCLA methodology (based on 765 clinical scenarios) and had four levels (necessary, appropriate, uncertain, inappropriate). The authors assessed minimal clinically important differences (MCID) in the VF-14 and in visual acuity by appropriateness level.

Gutierrez et al.[17] validated a priority scoring system for cataract surgery in terms of clinical variables, pre-intervention health status, appropriateness of surgery, and gain in visual acuity and health-related quality of life. The priority scoring system was based on RAND/UCLA methodology (based on 765 clinical scenarios) and had three levels (high, intermediate, low). A total of 5,257 patients who were on waiting lists for cataract surgery by phacoemulsification in Spain participated in the study. Patients were followed-up at three months post-surgery. The authors estimated changes in VF-14 and visual acuity by prioritization class using general linear models.

Choi et al.[18] used the RAND/UCLA methodology to create appropriateness criteria for cataract surgery based on 2,905 unique clinical scenarios, and evaluated this tool in 222 patients from 14 clinics in Korea who underwent cataract surgery from March to June 1997. Patients were followed prospectively at 12 months post-surgery. The appropriateness criteria had four levels (crucial, appropriate, uncertain, inappropriate). The authors assessed difference in visual acuity, the VF-14, a symptom score, a satisfaction with vision score, satisfaction with overall care, and self-reported health, by the appropriateness of surgery ratings, as a change in mean scores and with multiple linear regression.

Lundstrom et al.[19] constructed a clinical tool for setting indications for cataract surgery and validated it using prospectively collected data on 343 patients from nine Swedish clinics who were on waiting lists for cataract surgery. The NIKE tool was based on the Canadian Cataract Priority Criteria Tool and had four indication groups (1=greatest indication, 4=lowest indication). Patients were followed-up at one month post-surgery, and the authors reported changes in visual acuity, difficulties in daily life, cataract symptoms, and independence by indication group.

The guideline published by the American Academy of Ophthalmology in 2011[22] conducted a systematic review of the evidence for cataract surgery. The details of the search strategy were not included in the guideline document. The strength of the evidence from individual studies considered in the review was rated using the SIGN (Scottish Intercollegiate Guideline Network) scale (seven levels ranging from I++ to III), the rating of the overall quality of the evidence was based on GRADE (good, moderate, insufficient quality), and recommendations were also made based on GRADE classification (Strong or Discretionary recommendation).

The Royal College of Ophthalmologists in the United Kingdom published a guideline with the aim of improving quality of care for cataract surgery in 2010.[23] The recommendations were based on a review of the literature published in the previous ten years, and the strength of evidence of individual studies was based on a scale used by the National Institute for Clinical Excellence (NICE), which has six levels ranging from Ia to IV.

The Canadian Ophthalmological Society published evidence-based clinical practice guidelines for cataract surgery in the adult eye in 2008.[4] A systematic review of the literature was conducted that included evidence published from 2002 to 2007. The guideline was developed in accordance with the Canadian Medical Association's Handbook on Clinical Practice Guidelines, and the six domains of the AGREE instrument. Studies included in the review were assigned one of four levels of evidence, and recommendations were based on consensus opinion.

A detailed description of the evidence and recommendation scoring systems used by each of the three guidelines reviewed in this report is provided in Appendix 3.

Summary of Critical Appraisal

The detailed critical appraisal that was conducted using the AMSTAR,[10] the Downs and Black[11] instrument, and the AGREE II instrument[12] based on study design is provided in Table A.2 in Appendix 5.

The Cochrane systematic review by Keay et al.[13] was of good methodological quality. The review was based on methodology that was defined *a priori* and included a comprehensive literature search, duplicate study selection and data extraction, a study quality assessment, and a list of the studies that were excluded from the review. Their search did not include grey literature, publication bias was not assessed, and the sources of support for the included studies were not indicated.

With regard to the eight observational studies, most were generally of good quality. The most common study limitations were: non-randomized study (all eight studies); unclear if facilities are representative of those most patients are likely to be treated at (all eight studies); and unmasking patients, outcome assessors, or both.[15-21] Other limitations included inadequate accounting of losses to follow-up,[14,18,20] P-values not reported or inadequate use of statistical testing,[15,19,21] small sample size,[15,19] and timeframe of patient follow-up unclear.[17]

Among the three guidelines reviewed[4,22,23], the ones published by the Canadian Ophthalmological Society appeared to be strongest methodologically, and had the most direct links between evidence and recommendations. However it should be noted that for the recommendations that were most relevant to the present report, many were based on consensus. All three guidelines clearly described their overall objectives, used systematic methods to search for evidence, described a methodology for rating evidence that would be considered in making recommendations, and made some disclosure of competing interests. The selection criteria for the literature search conducted for the American guideline[22] were not explicitly provided in the document. The guideline from the UK[23] conducted a literature search that included the use of Medline, was restricted to English language reports published in the previous ten years, and included reports on cataracts surgery in adults and children. There did not appear to be any restriction on study type. The Canadian guideline[4] conducted an English-language literature search that included five databases and considered reports published between 2002 and 2007. Selected references were independently reviewed by at least two committee members. Two of the guidelines[4,22] had clearly been externally reviewed prior to publication. Because of the large number of limitations that were noted in the reviewed guidelines, they will not be listed here and it is recommended that the reader review them as listed in Table A.2 in Appendix 5.

Summary of Findings

A detailed summary of the findings from the studies and the guidelines that were reviewed is provided in Table A.3 of Appendix 6

Clinical Effectiveness

The meta-analysis conducted in systematic review by Keay et al.[13] found no significant difference between preoperative and no preoperative testing with respect to total intraoperative adverse events (Odds Ratio [OR] 1.02, 95%Confidence Interval [CI] 0.85 to1.22), total intraoperative hospitalizations (OR 0.60, 95%CI 0.14 to 2.51), total postoperative medical adverse events (OR 0.96, 95%CI 0.74 to 1.24]), total postoperative deaths (OR 0.50, 95%CI 0.05 to 5.52), total postoperative hospitalizations (OR 0.83, 95%CI 0.49 to 1.42), total intraoperative ocular adverse events (OR 0.99, 95%CI 0.71 to 1.38), or total postoperative ocular adverse events (OR 1.11, 95%CI 0.74 to 1.67). The authors concluded that routine pre-operative testing does not increase the safety of cataract surgery.

Las Hayas et al.[14] found a strong correlation between appropriateness and priority scores (r=0.96), as well as correlations between the appropriateness score and visual acuity (r=0.29), the appropriateness score and visual function (r=0.21), the priority score and visual acuity (r=-0.54), and the priority score and pre-intervention visual function: (r=-0.28). The authors concluded that the appropriateness scoring system strongly correlates with the priority scoring system, and can serve as a tool for simultaneously assessing appropriateness of cataract surgery and for assigning priority.

Las Hayas et al.[20] considered mean WCWL scores according to whether patients surpassed the MCID values in visual acuity and VF-14 after surgery and found no significant between-group differences (P > 0.4225). With regard to CCPS scores, the authors reported that patients with a VA change >=0.4 and a VF-14 change >15.57 (MCID cutoffs) had significantly higher mean CCPS scores compared with patients in other clinical improvement classifications (39.6 versus 33.1 to 35.2, P-value not reported). When the authors stratified mean WCWL and CCPS values

by the three categories of the IRYSSS appropriateness of indication tool (appropriate, uncertain, inappropriate), they found statistically significant between-group differences in mean scores with both tools (P < 0.0001) however mean scores were generally low, with the highest mean score being 41.5 (score range is 0 to 100, see Table A.3 in Appendix 6). In conclusion, the authors stated that given that the appropriateness tools should correlate with outcomes, they did not recommend using either the WCWL or the CCPS for appropriateness purposes.

Kuoppala et al.[15] reported the proportion of patients treated successfully among those who met each of the following criteria for surgery (range dependent on post-operative outcome measure used, i.e. visual acuity, opinion, 15D Vision, VF-14) as follows: visual acuity: 59%-85%; perceived trouble attributed to vision: 75%-88%; 15D Vision:69%-94%; VF-14:69%-90%; visual acuity and perceived trouble attributed to vision and 15D combined: 77%-91%; visual acuity and perceived trouble attributed to vision and VF-14 combined: 79%-88%; and the New Zealand score: 65%-81%. The authors' conclusions were that it would be sufficient to use only two global items, one on the subjective perception of visual problems, and a more neutral measure such as 15D. The authors recommended against using the VF-14, suggesting that it is cumbersome in routine use and follow-up.

Quintana et al.[21] based the appropriateness classification in their decision trees on pre-intervention and expected post-operative visual acuity value. For simple cataracts, surgery was considered to be inappropriate if VA was greater than 0.6. Surgery was appropriate if pre-intervention VA was less than or equal to 0.3 and predicted change in VA was greater than 0.46, or if pre-intervention VA was between 0.3 and 0.4 but without negative surgical complexities and had a predicted change in VA greater than 0.43. All other categories were considered uncertain. For cataract with ocular comorbidities, surgeries were considered appropriate if expected postoperative VA was greater than pre-intervention VA, with a predicted change in VA of more than 0.35, with the exception of patients with pre-intervention VA less than or equal to 0.1 who had expected post-operative VA between 0.2 and 0.4 and negative surgical complexity; surgeries were inappropriate if there was an expected postoperative VA of less than or equal to 0.1, an expected postoperative VA between 0.2 and 0.4 but a pre-intervention VA>=0.3, or an expected postoperative VA greater than or equal to 0.5 but a pre-intervention VA greater than 0.5. All other categories of patients were considered to be uncertain. Complication rates in the validation cohort in the appropriate, uncertain, and inappropriate groups were 17.5%, 11.4%, and 15.9%, respectively (Test for between-group difference, P = 0.01). Mean changes in the VF-14 (validation cohort), by appropriateness of surgery were +24.0, +18.9, and +15.9 in the appropriate, uncertain, and inappropriate categories, respectively (P < 0.001). Benchmark definitions for appropriate cataract extraction were also created based on pre- and expected post-intervention improvements in VA and the VF-14, MCID criteria for VA at pre-intervention levels, and expert clinician opinion. The sensitivity, specificity, and the area under the curve (AUC) for the regression tree results were compared with these benchmark definitions. For simple cataract, sensitivity was 82.8 (95%CI 82.8 to 84.8), specificity was 36.2 (95% CI 29.7 to 42.7), and the AUC was 0.60 (95%CI 0.56 to 0.63). For cataract with ocular comorbidities, sensitivity was 82.8 (95%CI 78.7 to 86.9), specificity was 49.1 (95% CI 41.6 to 56.6), and the AUC was 0.66 (95%CI 0.62 to 0.70). the authors concluded that a simple decision tree based on changes in visual acuity can help identify appropriate patients for cataract extraction and be used to evaluate clinical practice or for quality control.

Quintana et al.[16] reported the percentage of patients achieving a MCID in VF-14 and in visual acuity at three months, by appropriateness category, and by type of cataract. For simple

cataract, the percentage of patients achieving a MCID with the VF-14 was 68.38% in patients in whom surgery was considered necessary, 57.95% in patients in whom surgery was considered appropriate, 49.20% in uncertain surgeries, and 21.36% in inappropriate surgeries. The percentage of patients achieving MCIDs in visual acuity for these four groups were 69.07%, 60.48%, 49.57%, and 26.47%, respectively. For cataracts with retinopathy or other associated pathology, the percentage of patients achieving MCID with the VF-14 in the necessary, appropriate, uncertain, and inappropriate surgery groups were 64.62%, 72.11%, 58.23%, and 45.00%, respectively. For MCIDs in visual acuity, these percentages were 42.86%, 49.40%, 54.29%, and 37.65%, respectively. Differences between the appropriateness categories (for each type of cataract and outcome measure) were tested using chi-square, and all were significant at P<0.0001. The authors concluded that the results of their study supported the validity of the appropriateness criteria for cataract extraction by showing greater benefit among patients who underwent interventions considered to be necessary or appropriate, compared with those who underwent procedures classified as inappropriate. They further concluded that these results support the use of the criteria for the development of guidelines or to determine the appropriateness of cataract extraction for individual patients.

Using linear regression methods, Gutierrez et al.[17] reported the adjusted (for baseline values and other factors) change in visual acuity and in VF-14 scores by prioritization class. With the reference priority class being “low”, the change in visual acuity for the high priority class was β=0.21 (P<0.0001), and for the intermediate priority class it was β=0.15 (P<0.0001)
For the VF-14 score, the change in the high priority class was β=9.34 (P=0.001), and for the intermediate class it was β=10.90 (P=0.0003). The authors concluded that their priority scoring systems was able to identify patients with poorer visual acuity and vision-related quality of life who were more likely to benefit from cataract extraction, and that the scoring system offered a rational way to prioritize patients on waiting lists.

Choi et al.[18] reported mean changes in outcome at 12 months by appropriateness criteria. A summary of their results for visual acuity, the VF-14, and the symptom score are provided in Table 2 below.

Table 2: Change in outcome by appropriateness criteria as reported by Choi et al.[18]

Appropriateness Criterion	Mean change at 12 months (standard deviation)		
	Visual acuity	VF-14	Symptom score
Crucial	0.75 (0.39)*	35.22 (22.86)*	6.31 (5.29)*
Appropriate	0.57 (0.51)*	27.09 (22.38)*	4.37 (4.98)
Uncertain	0.13 (0.46)	11.01 (17.07)	3.00 (5.38)
Inappropriate	0.23 (0.19)	12.79 (26.83)	2.82 (5.85)
ANOVA (F-test)	P<0.001	P<0.001	P=0.006

*Duncan test, statistically significantly different compared with uncertain and inappropriate

No significant differences were found with respect to satisfaction with vision, satisfactions with overall care, or self-reported health. In multiple linear regression analysis, there was a trend that the appropriate rated surgeries were related to the successful change of visual function (β=2.29, *P* = 0.015) and satisfaction with vision (β=3.84, *P* = 0.014) in 12 month postoperative period. The authors concluded that surgeries rated as crucial or appropriate had better outcomes than surgeries rated as uncertain or inappropriate.

Lundstrom et al.[19] reported the mean percent reduction on the total indication score due to surgery after one month for groups one, two, three, and four (1=greatest indication, 4=lowest

indication) to be 58.8%, 50.0%, 33.3%, and 37.5%, respectively, for first-eye surgery. For second eye or bilateral same-day surgery, these percentages were 72.3%, 55.6%, 50.0%, and 16.7%, respectively. Mean indication scores for visual acuity, difficulties in daily life, cataract symptoms, and independence dropped one month after surgery for groups one and two. A small change was seen in group three and no change was seen in group four. No statistical testing was done on these changes. The before and after indication scores are provided in Table A.3 of Appendix 5. The authors concluded that the impact of surgery was higher for patients with stronger indications for surgery, and noted that the indications groups are now being routinely used in Sweden, and that ophthalmic clinics are advised not to operate on patients in indication group four.

Guidelines

The guideline published by the American Academy of Ophthalmology[22] recommended that cataract surgery should be based on a consideration of visual acuity, visual impairment, and the potential for functional benefits. This recommendation was rated as strong and based on evidence that was generally considered to be good in quality. The authors of the guideline noted that no single measure or test adequately describes the effect of cataract on patient visual status and functionality, and so more than one test is required. They added that visual acuity tests should not be the sole basis for decision to operate.

The guideline of the Royal College of Ophthalmologists[23] provided guidance on diagnosis and evaluation of visual impairment, and noted that there is no single measure to assess the effect of cataract on patients or to decide the threshold for surgery. The guideline recommended the taking of a detailed medical history, and suggested that a complete ophthalmic examination should include a measurement of visual acuity, a pupil examination, an external eye examination, measurement of intraocular pressure, a full slit lamp examination, a dilated examination of the cataract and fundus, biometry, and if indicate, photokeratometry. There was no rating associated with this guidance

The guideline of the Canadian Ophthalmological Society[4] provided guidance on the indication for cataract surgery, specifically that cataract surgery is indicated primarily for the correction of visual impairment that cannot be adequately improved non-surgically [Level 3 evidence]; stated that cataract surgery is indicated to meet visual acuity standards when a patient's visual acuity falls below legal standards for activities (e.g. driving, military service, or flying) [Consensus]; and recommended that the work-up of a patient being considered for cataract surgery should answer the following questions: (a) is the cataract primarily responsible for the vision loss? (b) are there any comorbid conditions that may be exacerbated by the surgery? (c) are there any comorbid conditions that may complicate the execution of the surgery or minimize the visual improvement? According to the guideline authors, answering these questions allows the stratification of surgical risk that should be presented to the patient as part of the consent process [Level 3 evidence].

Limitations

No randomized studies of interventions for prioritizing or determining the appropriateness of cataract surgery patients were identified. One of the benefits of a randomized design is to reduce selection bias, however, most of the studies reviewed considered or controlled for potential confounders, and so it is unclear if the lack of randomized studies is a true limitation in this review.

If a randomized trial were to be undertaken, the choice of comparator would be an important consideration (e.g. specific tests, waiting list). The fact that there were no studies that explicitly looked at appropriateness and prioritization criteria as an intervention (i.e. compared with no intervention, or with current standard of practice) leaves a gap in our understanding of how these tools would perform if implemented prospectively in actual clinics, if compared to other prioritization methods or to standard of practice for selecting patients for cataract surgery. This consideration is especially important if standard of practice varies between clinics and jurisdictions.

None of the guidelines reviewed provided guidance for systematically prioritizing patients or for determining which patients are most appropriate candidates for cataract surgery.

CONCLUSIONS AND IMPLICATIONS FOR DECISION OR POLICY MAKING

Eight observational studies that validated tools to determine appropriateness of cataract surgery,[14,16,18] prioritize patients for cataract surgery,[17,20] or explore indications[19,21] or the predictive ability of tools to determine better cataract surgery outcomes[15] were identified, and all but one[20] found that their criteria were able to discriminate patients who were in greater need of surgery, and these patients also demonstrated better outcomes. In one study, better outcomes were observed after adjusting for baseline values.[17] At the same time, none of these studies were interventional and so we cannot answer the question regarding the effectiveness of applying these tools in a clinical setting, versus not using them.

While each of the guidelines reviewed provided some common guidance on how patients should be evaluated for cataract surgery (e.g. assessment of visual acuity, assessment of visual function, patient's general ability to function, and evaluation of comorbidities), none offered specific guidance on prioritizing surgical candidates.

Tools for determining appropriateness of cataract surgery or for prioritizing patients for cataract surgery should be further evaluated in comparative intervention studies.

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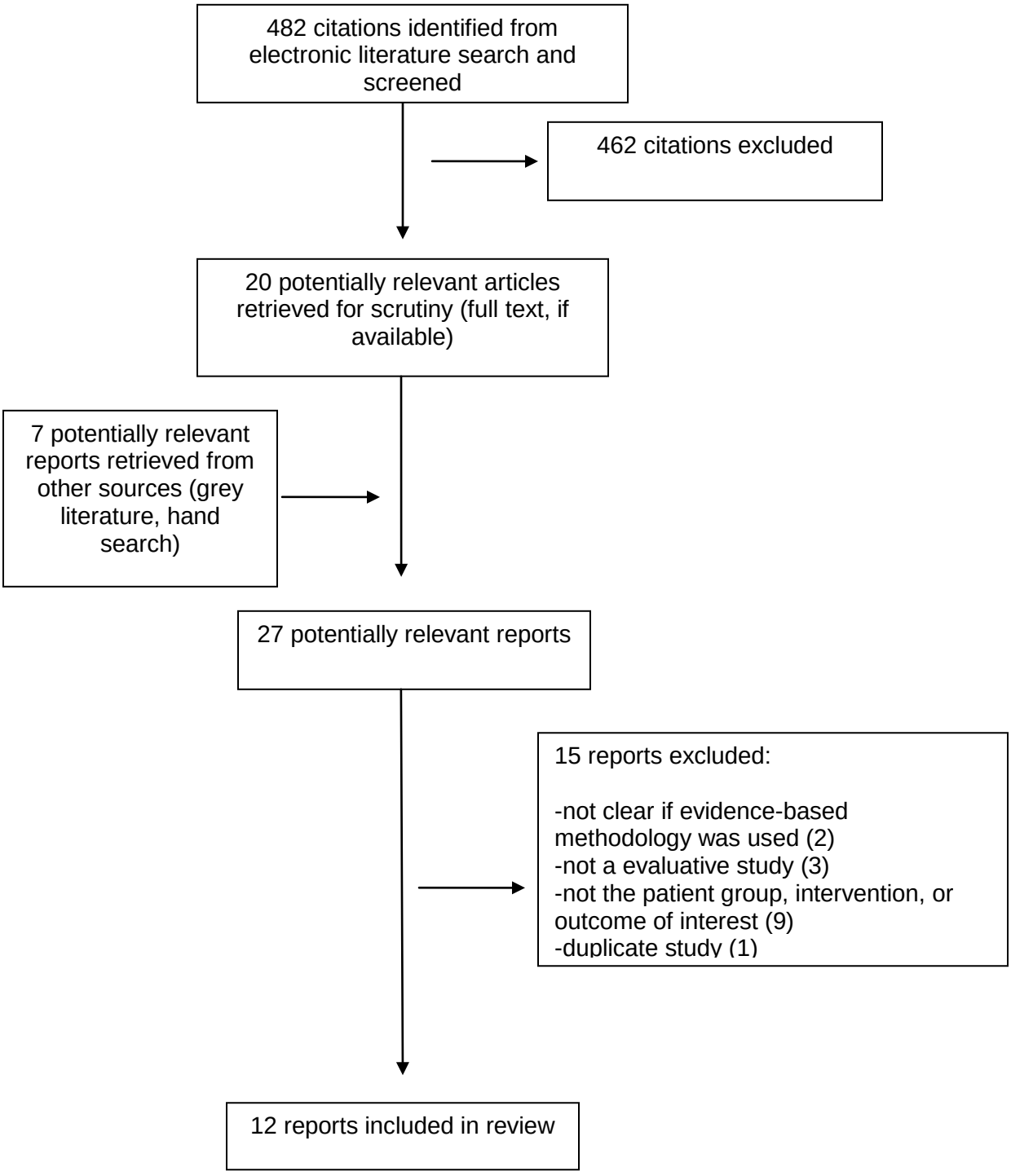
APPENDIX 1: Selection of Included Studies



APPENDIX 2: Tools for prioritizing cataract surgery patients

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APPENDIX 3: Scoring and grading methodology used by the guidelines reviewed in this report

American Academy of Ophthalmology (2011)[22]

Rating of evidence of individual studies

Rating	Criteria
I++	High-quality meta-analyses, systematic reviews of randomized controlled trials (RCTs), or RCTs with a very low risk of bias
I+	Well-conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias
I-	Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias
II++	High quality systematic reviews of case-control or cohort studies; High quality case-control or cohort studies with a very low risk of confounding bias and a high probability that the relationship is causal
II+	Well-conducted case-control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal
II-	Case-control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal
III	Nonanalytic studies (e.g. case reports, case series)

Quality rating of body of evidence:

Quality rating	Definition
Good	Further research is unlikely to change our confidence in the estimate of effect
Moderate	Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate
Insufficient	Further research is very likely to an important impact on our confidence in the estimate of effect and is likely to change the estimate. Any estimate of effect is very uncertain

Key recommendation definitions:

Strong recommendation:	used when the desirable effects of an intervention clearly outweigh the undesirable effects or clearly do not.
Discretionary recommendation:	used when the trade-offs are less certain – either because of low quality evidence or because evidence suggests that desirable and undesirable effects are closely balanced.

The Royal College of Ophthalmologists (2010)[23]

Grading of Evidence:

Ia - Systematic review of meta-analysis of randomized controlled trials
Ib - At least one randomized controlled trial
IIa - At least one well designed controlled study without randomization
IIb - At least one well designed quasi-experimental study, such as a cohort study
III - Well-designed non-experimental descriptive studies, such as comparative studies, correlation studies,
case-control studies and case series
IV - Expert committee reports, opinions and/or clinical experience of respected authorities

The Canadian Ophthalmological Society (2008)[4]

Criteria for assigning levels of evidence to the published studies:

Study type	Level	Criteria
Diagnostic	1	(i) Independent interpretation of test results (without knowledge of the result of the diagnostic or gold standard; (ii)Independent interpretation of the diagnostic standard (without knowledge of the test result); (iii)Selection of people suspected (but not known) to have the disorder; (iv)Reproducible description of both the test and diagnostic standard; (v)At least 50 patients with and 50 patients without the disorder.
	2	Meets 4 of the Level I criteria
	3	Meets 3 of the Level I criteria
	4	Meets 1 or 2 of the Level I criteria
Treatment and prevention	1A	Systematic overview or meta-analysis of high quality, randomized, controlled trials; Appropriately designed randomized controlled trial with adequate power to answer the question posed by the investigators
	1B	Nonrandomized clinical trial or cohort study with indisputable results
	2	Randomized controlled trial or systematic overview that does not meet Level I criteria
	3	Nonrandomized clinical trial or cohort study
	4	Other
Prognostic	1	(a)Inception cohort of patients with the condition of interest, but free of the outcome of interest (b)Reproducible inclusion/exclusion criteria (c)Follow-up of at least 80% of subjects (d)Statistical adjustment for extraneous prognostic factors (confounders) (e)Reproducible description of outcome measures
	2	Meets criterion (a) above plus 3 of the other criteria
	3	Meets criterion (a) above plus 2 of the other criteria
	4	Meets criterion (a) above plus 1 of the other criteria

APPENDIX 4: Characteristics of Included Studies

Table A.1: Characteristics of Included Studies

First author/ organization, publication year	Study objectives	Research approach and study design*	Outcomes
Systematic review			
Keay et al.[13] (2012)	"To investigate the evidence for reductions in adverse events through preoperative medical testing." (p.1)	Included randomized controlled trials that compared preoperative testing to no preoperative testing to detect co-morbid medical conditions, prior to age-related cataract surgery. No date or language restriction, with publication date up to and including December 2011. Cochrane Risk of Bias assessment was performed for each of the selected studies	The primary outcome was the rate of medical adverse events which occurred within seven days of surgery, and which had a plausible causal relationship to the surgery. Adverse events were classified as intraoperative or postoperative (defined by each study). A secondary outcome was ocular adverse events, as reported.
Observational studies			
Las Hayas et al[14] (2010a) Spain	"To determine whether a system originally developed to ascertain the appropriateness of cataract intervention may also be used to prioritize patients on cataract extraction waiting lists." (p.194)	Study design: prospective observational Tools: IRYSS-Cataract Appropriateness Score Patients: sample of 5448 consecutive patients who underwent cataract surgery between October 2004 and July 2005. Follow-up period: 6 weeks and 3 months Analytic method: validation using GLM, correlation	Correlation with IRYSS-Cataract Priority Score, visual acuity, and visual function.
Las Hayas et al[20] (2010b) Spain	"To test two systems developed to prioritize patients on waiting lists for cataract surgery…as tools for judging the appropriateness of the intervention." (p.e1)	Study design: cross-sectional study with follow-up Tools: WCWL and the CCPS Patients: 1723 patients awaiting cataract surgery by phacoemulsification between October 2004 and July 2005. Follow-up period: 6 weeks and 3 months Analytic method: ANOVA, Jonckeere-Terpstra	Comparison with visual acuity and VF-14 before and after surgery; Sensitivity of priority systems validated using the IRYSS-Cataract Appropriateness score.

First author/ organization, publication year	Study objectives	Research approach and study design*	Outcomes
		test, t-test, correlation coefficients	
Kuoppala et al[15] (2010) Finland	"…to define preoperative criteria for successful cataract surgery based on various predictive factors." (p.328)	Study design: prospective observational Tools: Visual acuity, VF-14, 15D HRQOL Questionnaire, New Zealand Priority Criteria Patients: 93 consecutive patients who underwent cataract surgery in 2003 Follow-up period: one month and nine months Analytic method: *Post hoc* evaluation of criteria for surgery using logistic regression	Odds of diagnostic success and odds of treatment success given specific criteria (i.e. each of the tools under evaluation, as well as physician opinion).
Quintana et al.[21] (2010) Spain	"To develop decision trees based on prospectively collected data for determining the appropriateness of cataract surgery." (p.1471)	Study design: prospective observational Tools: two decision trees – one for simple cataract and one for cataract with other ocular comorbidities Patients: 3691 patients in derivation cohort, and 2416 patients in validation cohort, all waiting for cataract surgery by phacoemulsification between October 2004 and July 2005. Follow-up period: 6 weeks and 3 months Analytic method: multivariate linear regression for decision trees; differences in proportions between group not stated; sensitivity, specificity, and AUC.	Preintervention visual acuity and changes at 6 weeks and three months;
Quintana et al[16] (2009) Spain	"The objective of this study was to validate newly developed explicit appropriateness criteria." (p.409)	Study design: prospective observational Tools: Appropriateness criteria based on RAND methodology Patients: 4335 scheduled for cataract surgery between October 2004 and July 2005 Follow-up period: 6 weeks and 3 months post-surgery Analytic method: Percent change in MCID	Change in VF-14 and visual acuity by appropriateness criteria

First author/ organization, publication year	Study objectives	Research approach and study design*	Outcomes
Gutierrez et al[17] (2009) Spain	To validate a previously developed priority scoring system in terms of clinical variables, pre-intervention health status, appropriateness of surgery and gain in visual acuity and health related quality of life.	Study design: prospective observational Tools: Prioritization criteria developed based on modification of RAND-UCLA methodology Patients: 5257 patients on waiting lists for cataract surgery by phacoemulsification Follow-up period: 6 weeks and 3 months post-surgery Analytic method: Change in outcome estimated using GLM	Change in VF-14 and visual acuity by prioritization class
Choi et al[18] (2009) Korea	"…to assess whether cataract surgeries ratings as appropriate (crucial and appropriate) were associated more with changes in postoperative outcomes, such as visual acuity, visual function-14, symptom score, and satisfaction with overall, than uncertain or inappropriate cataract surgeries. These evidences contribute to validity of the RAM." (p.369)	Study design: prospective observational Tool: Appropriateness criteria developed based on RAND-UCLA methodology Patients: 222 patients in 14 clinics who underwent cataract surgery From March to June 1997 Follow-up period: 12 months post-surgery Analytic method: Change in mean difference in outcome by appropriateness of surgery rating, and degree of appropriate surgery associated with changes in outcome using multiple linear regression.	Change in visual acuity, VF-14, Symptom score, Satisfaction with vision, Satisfaction with overall care, self-reported health.
Lundstrom et al[19] (2006) Sweden	The purpose of this study was to construct a new clinical tool for setting indications for cataract surgery and to validate this tool. (p.496)	Study design: prospective observational Tool: A tool for establishing levels of indication for cataract surgery called the NIKE, which is based on the Canadian Cataract Priority Criteria Tool Patients: 343 patients on waiting lists for cataract surgery from 9 clinics. Follow-up period: 1 month post-surgery Analytic method: Percent reduction of surgery on total indication score, change in median scores in visual acuity, difficulties in daily life, cataract symptoms, and independence.	Changes in visual acuity, difficulties in daily life, cataract symptoms, and independence

First author/ organization, publication year	Study objectives	Research approach and study design*	Outcomes
Guidelines			
American Academy of Ophthalmology [22] (2011)	Among the stated clinical objectives: "Perform cataract surgery when there is expectation that it will benefit the patient's function and when the patient elects this option." (p.7)	Recommendations based on systematic review of the evidence. Rating of strength evidence of individual studies using SIGN scale (seven levels from I++ to III). Rating of overall quality of evidence as defined by GRADE (good, moderate, insufficient quality). Recommendations made based on GRADE (Strong or Discretionary recommendation). Details of literature search strategy not provided in guideline document	General outcome criteria include: Reduction in visual symptoms Improvement in visual function Achievement of desired refractive outcome Improvement in physical function, mental health, and quality of life
Royal College of Ophthalmologists[23] (2010)	"The aim of these guidelines is to identify good clinical practice, set standards of patient care and safety and provide a benchmark for outcomes within which high quality cataract surgery can be practised." (p.3)	Recommendations based on review of literature published in previous ten years Rating of strength of evidence of individual studies based on NICE scale (six levels from Ia to IV)	Aims of cataract surgery include: Restoration of vision to meet the patient's needs Achievement of the desired refractive outcome Improvement in quality of life Ensuring patient safety and satisfaction
Canadian Ophthalmological Society[4] (2008)	"The objective of this document is to provide guidance to Canadian surgical ophthalmologists and allied health care professionals on current indications for surgery	Systematic review of the literature from 2002 to 2007 Guideline developed in accordance with Canadian Medical Association's Handbook on Clinical Practice Guidelines, and the six	Not stated

First author/ organization, publication year	Study objectives	Research approach and study design*	Outcomes
	and pre-, peri-, and postoperative considerations for adult cataracts to minimize risk and maximize successful patient outcomes." (p.S7)	domains of the AGREE instrument. Studies included in the review were assigned one of four levels of evidence	

*For systematic reviews this includes the literature search strategy and method used to assess study quality; for evaluative studies this includes the study design, intervention and tools, included patients, follow-up period, and analytic method; for guidelines this includes the evidence-based methodology used, the literature search strategy, the method used for rating the quality of evidence, and the grading system for the recommendations.
AUC: area under the curve; CCPS: Catalan Agency for Health Technology Assessment and Research Cataract Priority System; GLM: general linear model; HRQOL: health-related quality of life; MCID: minimal clinically important difference; NICE: National Institute of Clinical Excellence; NIKE: Nationell Indikationsmodell for Kataraktextraktion; RAM: RAND/UCLA Appropriateness Method; SIGN: Scottish Intercollegiate Guidelines Network; VF: visual function; WCWL: Western Canadian Waiting List

APPENDIX 5: Summary of Critical Appraisal

Table A.2: Summary of Critical Appraisal of Included Studies

First author/ organization, publication year, and country	Strengths	Limitations
Keay et al.[13] (2012)	• A priori design • Duplicate study selection and data extraction • Comprehensive literature search • Excluded studies list provided • Characteristics of included studies and quality assessment provided • Scientific quality of included study used appropriately in formulating conclusion • Declarations of interest made in the systematic review	• Grey literature not included • Publication bias not assessed • Potential sources of support of included studies not indicated
Las Hayas et al[14] (2010a) Spain	• Study objective clearly described • Main outcomes clearly described • Patient characteristics clearly described • Intervention clearly described • Distribution of confounders described • Main findings clearly described • Random variability for main outcomes estimated • Probability values reported • Participating patients representative of population under study • Masking of physicians and nurses to study objectives • Appropriate statistical tests used • Valid and reliable outcome measures used • All patients seen in similar time period • Losses to follow-up taken into account • Sufficient statistical power	• While reasons for losses to follow-up described, characteristics of losses to follow-up not analyzed • Unclear if facilities representative • Non-randomized study

First author/ organization, publication year, and country	Strengths	Limitations
Las Hayas et al[20] (2010b) Spain	• Study objective clearly described • Main outcomes clearly described • Patient characteristics clearly described • Intervention clearly described • Main findings clearly described • Random variability for main outcomes estimated • Probability values reported • Participating patients representative of population under study • Appropriate statistical tests used • Valid and reliable outcome measures used • All patients seen in similar time period • Sufficient statistical power	• Principle confounders not clearly described • Unclear if outcome assessors masked • Details on patients excluded or lost to follow up (if any) not provided • Unclear if facilities representative • Non-randomized study
Kuoppala et al[15] (2010) Finland	• Study objective clearly described • Main outcomes clearly described • Patient characteristics clearly described • Intervention clearly described • Distribution of confounders described • Main findings clearly described • Random variability for main outcomes estimated • Participating patients representative of population under study • Appropriate statistical tests used • Valid and reliable outcome measures used • All patients seen in similar time period • Good initial response rate and no losses to follow up	• Probability values not reported • Outcome assessors not masked • Small sample size and statistical power may have been insufficient • Unclear if facilities representative • Non-randomized study

First author/ organization, publication year, and country	Strengths	Limitations
Quintana et al.[21] (2010) Spain	• Study objective clearly described • Main outcomes clearly described • Principal confounders clearly described • Patient characteristics clearly described • Intervention clearly described • Main findings clearly described • Participating patients representative of population under study • Valid and reliable outcome measures used • All patients seen in similar time period • Sufficient statistical power	• Probability values reported however statistical test used for certain outcomes not clearly indicated • Random variability for main outcomes not always estimated • Excluded patients noted but not compared with responders • Unclear if outcome assessors masked • Unclear if facilities representative • Non-randomized study
Quintana et al[16] (2009) Spain	• Study objective clearly described • Main outcomes clearly described • Patient characteristics clearly described • Intervention clearly described • Distribution of confounders described • Main findings clearly described • Random variability for main outcomes estimated • Participating patients representative of population under study • Appropriate statistical tests used • Valid and reliable outcome measures used • All patients seen in similar time period • Good response rate and losses to follow up accounted for and non-responders compared with responders • Probability values reported • Large sample size, sufficient statistical power	• Outcome assessors not masked • Unclear if facilities representative • Non-randomized study

First author/ organization, publication year, and country	Strengths	Limitations
Gutierrez et al[17] (2009) Spain	• Study objective clearly described • Main outcomes clearly described • Patient characteristics clearly described • Intervention clearly described • Distribution of confounders described • Main findings clearly described • Random variability for main outcomes estimated • Participating patients representative of population under study • Appropriate statistical tests used • Valid and reliable outcome measures used • Good response rate, with some comparison made between responder and non-responders • Probability values reported • Large sample size, sufficient statistical power	• Time frame during which all patients evaluated for study not clear • Outcome assessors not masked • Unclear if facilities representative • Non-randomized study
Choi et al[18] (2009) Korea	• Study objective clearly described • Main outcomes clearly described • Patient characteristics clearly described • Intervention clearly described • Distribution of confounders described • Main findings clearly described • Random variability for main outcomes estimated • Participating patients representative of population under study • Appropriate statistical tests used • Valid and reliable outcome measures used • Probability values reported • Small sample size however study appears to have had sufficient statistical power	• Unclear if any patients were excluded or lost to follow-up • Outcome assessors not masked • Unclear if facilities representative • Non-randomized study

First author/ organization, publication year, and country	Strengths	Limitations
Lundstrom et al[19] (2006) Sweden	• Study objective clearly described • Main outcomes clearly described • Patient characteristics clearly described • Intervention clearly described • Intervention clearly described • Distribution of confounders described • Main findings clearly described • Participating patients representative of population under study • Valid and reliable outcome measures used	• Random variability for main outcomes not reported • Statistical testing on changes over time not performed • Comparison between participant and nonparticipants not made • Sample size likely sufficient to detect changes over time, however testing not done • Outcome assessors not masked • Unclear if facilities representative • Non-randomized study
American Academy of Ophthalmology [22] (2011)	• Overall objectives described • Health questions specifically described • Relevant population clearly described • Target users of guideline clearly defined • Systematic methods used to search for evidence however criteria for searching for evidence not explicitly described in guideline • Methods for formulating recommendations clearly described • Health benefits, side effects, and risks have been considered in formulating recommendations • Guideline reviewed by external experts before publication • Key recommendations clearly identifiable • Different options for treatment clearly presented • Resource implications have been considered • Quality of care criteria provided • Competing interests of guideline development group members have been recorded	• Unclear if guideline development group includes individuals from all relevant professional groups • Unclear whether patients' views and preferences were sought • Strengths and limitations of body of evidence not clearly described • Link between the recommendations and the supporting evidence not clear • Procedure for updating guideline not provided • Recommendation does not provide specific criteria • Facilitators and barriers not discussed • Advice or tools for guideline implementation not provided • No explicit statement regarding funding body and any potential influence

First author/ organization, publication year, and country	Strengths	Limitations
Royal College of Ophthalmologists [23] (2010)	• Overall objectives described • Health questions specifically described • Relevant population clearly described • Systematic methods used to search for evidence • Methods for formulating recommendations clearly described • Health benefits, side effects, and risks have been considered in formulating recommendations • Patients' views and preferences were sought • Quality of care criteria provided • Competing interests of Chair have been noted	• Target users of guideline not clearly defined • Stated that guideline development group included individuals from all relevant professional groups, however working party members include ophthalmologists only • Unclear if the guidelines were reviewed by external experts before publication • Strengths and limitations of body of evidence not clearly described • Key recommendations not clearly identifiable • Link between the recommendations and the supporting evidence not clear • Procedure for updating guideline not provided • Recommendation does not provide specific criteria • Different options for treatment not clearly presented • Resource implications have not been considered • Facilitators and barriers not discussed • Advice or tools for guideline implementation not provided • Competing interests of guideline development group members have not been recorded

First author/ organization, publication year, and country	Strengths	Limitations
Canadian Ophthalmological Society[4] (2008)	• Overall objectives described • Health questions specifically described • Relevant population clearly described • Target users clearly defined • Systematic methods used to search for evidence • Criteria for selecting evidence clearly described • Methods for formulating recommendations clearly described • Health benefits, side effects, and risks have been considered in formulating recommendations • Explicit link made between evidence and recommendations however many recommendations based on consensus • Guideline was reviewed externally by experts • Recommendations are clear and unambiguous • Different options for management of the condition or health issue are presented • Key recommendations easily identifiable • Sources of external funding noted and statement that it did not influence content of guideline was made • Competing interests of guideline development group members have been recorded	• Unclear If patients views and preferences were considered • Unclear if guideline development group included individuals from all relevant professional groups • Strengths and limitations of body of evidence not clearly described • Facilitators and barriers to guideline application not described • Tools/advice for implementation not provided • Potential resource implications not considered • Monitoring/auditing criteria not provided • Procedure for updating the guideline not provided

APPENDIX 6: Summary of Findings

Table A.3: Findings and Recommendations of Included Studies

First author/ organization, publication year, and country	Results / Recommendations	Authors' Conclusions
Systematic Reviews		
Keay et al.[13] (2012)	Three RCTs were identified: Cavallini (2004); Italy; 1,276 patients; Lira (2001); Brazil;1,025 patients; Schein (2000); USA, Canada; 19,557 patients. Risk of bias generally considered low however participants and physicians were not masked in Lira (2001) and Schein (2000). Meta-analyses found no significant difference between preoperative and no preoperative testing with respect to: Total intraoperative adverse events: OR 1.02 [95%CI 0.85,1.22] Total intraoperative hospitalizations: OR 0.60 [95%CI 0.14,2.51] Total postoperative medical adverse events: OR 0.96 [95%CI 0.74,1.24] Total postoperative deaths: OR:0.50 [95%CI 0.05,5.52] Total postoperative hospitalizations: OR:0.83 [95%CI 0.49,1.42] Total intraoperative ocular adverse events: OR: 0.99 [95%CI 0.71,1.38] Total postoperative ocular adverse events: OR 1.11 [95%CI 0.74,1.67]	"This review has shown that routine pre-operative testing does not increase the safety of cataract surgery." (p.2)
Observational Studies		
Las Hayas et al[14] (2010a) Spain	Correlation between: • appropriateness and priority scores: r=0.96 • appropriateness score and visual acuity: r=0.29 • appropriateness score and visual function: r=0.21 • priority score and visual acuity: r=-0.54 • priority score and pre-intervention visual function: r=-0.28	"The appropriateness scoring system strongly correlates with the priority scoring system. This easy-to-use scoring system could serve as a tool for simultaneously assessing the appropriateness of cataract surgery and assigning priority." (p.194)
Las Hayas et al[20] (2010b)	WCWL mean (standard deviation) scores according to whether patients surpassed the MCID values in visual acuity (VA) and VF-14	"Given that the appropriateness tools should correlate with outcomes, we recommend

First author/ organization, publication year, and country	Results / Recommendations	Authors' Conclusions
Spain	after surgery: VF-14 change <15.57 / VF-14 change>15.57 VA change <0.4: 24.4 (21.1) / 26.7 (21.1) VA change>=0.4: 23.3 (11.4) / 28.2 (22.1) No significant between-group differences (p>0.4225) CCPS mean (standard deviation) scores according to whether patients surpassed the MCID values in visual acuity (VA) and VF-14 after surgery: VF-14 change <15.57 / VF-14 change>15.57 VA change <0.4: 33.1 (19.7) / 33.9 (19.6) VA change>=0.4: 35.2 (20.1) / 39.6 (20.6) CCPS score among patients with VA change >=0.4 and VF-14 change >15.57 significantly higher than other categories (p-value not reported) Mean (standard deviation) scores in the WCWL and the CCPS according to categories of the IRYSSS appropriateness of indication tool: Appropriate / Uncertain / Inappropriate / Total WCWL: 33.6 (20.6) / 11.8 (14.2) / 7.0 (11.4) / 25.7 (21.5) CCPS: 41.5 (19.8) / 24.8 (16.8) / 23.9 (16.3) / 35.7 (20.4) Statistically significant between-group differences with both tools (P<0.0001) however mean scores were generally low, with the highest mean score being 41.5 (score range is 0 to 100)	using neither the WCWL nor the CCPS for appropriateness purposes. Incorporating new criteria into these systems may improve the correlation with important outcomes and their adequacy for use as appropriateness tools." (p.e1)
Kuoppala et al[15] (2010) Finland	Proportion of patients diagnosed successfully among those who met each of the following criteria for surgery:	"It seems sufficient to use only two global items, one on the subjective perception of

First author/ organization, publication year, and country	Results / Recommendations	Authors' Conclusions
	Visual acuity: 82% Perceived trouble attributed to vision: 75% 15D Vision:70% VF-14:77% Visual acuity and perceived trouble attributed to vision and 15D: 83% Visual acuity and perceived trouble attributed to vision and VF-14:81% New Zealand score: 72% Proportion of patients treated successfully among those who met each of the following criteria for surgery (range dependent on post-operative outcome measure used, i.e. visual acuity, opinion, 15D Vision, VF-14): Visual acuity: 59%-85% Perceived trouble attributed to vision: 75%-88% 15D Vision:69%-94% VF-14:69%-90% Visual acuity and perceived trouble attributed to vision and 15D: 77%-91% Visual acuity and perceived trouble attributed to vision and VF-14: 79%-88% New Zealand score: 65%-81%	visual problems and one on a more neutral view on visual function such as the 15D vision question; a battery of 14 questions is cumbersome in routine use and follow-up." (p.331)
Quintana et al.[21] (2010) Spain	<u>Appropriateness classification from decision trees, based on VA values:</u> Simple cataract: Inappropriate: VA>0.6 Appropriate: pre-intervention VA<=0.3 and predicted change in VA>0.46; prentervention VA between 0.3 and 0.4 but without negative surgical complexities and a predicted change in VA >0.43. Uncertain: all other categories	"A simple decision tree based on changes in VA can help identify appropriate patients for cataract extraction and be used to evaluate clinical practice or for quality control." (p.1471)

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	Cataract with ocular comorbidities: Appropriate: expected postoperative VA>pre-intervention VA, with a predicted change in VA of>0.35, with the exception of patients with preintervention VA<=0.1 who had post-operative VA between 0.2 and 0.4 and negative surgical complexity; Inappropriate: Expected postoperative VA of <=0.1, expected postoperative VA between 0.2 and 0.4 but a preintervention VA>=0.3, and expected postoperative VA>=0.5 but preintervention VA>0.5; Uncertain: all other categories Complication rates in validation cohort by appropriateness of surgery: Appropriate: 17.5% Uncertain:11.4% Inappropriate:15.9% (P=0.01) Mean changes in VF-14 in validation cohort, by appropriateness of surgery: Appropriate: +24.0 Uncertain:+18.9 Inappropriate:+15.9 (P<0.001) Benchmark definitions for appropriate cataract extraction were also created based on pre-and expected post intervention improvements in VA and the VF-14, MCID criteria for VA at pre-intervention levels, and expert clinician opinion. The sensitivity, specificity, and AUC for the regression tree results were compared with these benchmark definitions (95% confidence interval given in parentheses): Cataract type Sensitivity Specificity AUC Simple 82.8 (82.8-84.8) 36.2 (29.7-42.7) 0.60 (0.56-0.63) Comorbidities 82.8 (78.7-86.9) 49.1 (41.6-56.6) 0.66 (0.62-0.70)	

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Quintana et al[16] (2009) Spain	% patients achieving MCID in VF-14 and visual acuity at three months, according to appropriateness category, by type of cataract: Simple cataract, VF-14: Necessary:68.38% Appropriate:57.95% Uncertain:49.20% Inappropriate:21.36% Simple cataract, visual acuity: Necessary:69.07% Appropriate:60.48% Uncertain:49.57% Inappropriate:26.47% Cataract with retinopathy or other associated pathology, VF-14: Necessary:64.62% Appropriate:72.11% Uncertain:58.23% Inappropriate:45.00% Cataract with retinopathy or other associated pathology, visual acuity: Necessary:42.86% Appropriate:49.40% Uncertain:54.29% Inappropriate:37.65% Differences between the appropriateness categories tested using chi-square; all were significant at $p<0.0001$	"…the results of this study support the validity of newly developed explicit appropriateness criteria for cataract extraction by showing greater benefits among patients who underwent interventions deemed as necessary or appropriate compared with those who underwent procedures classified as inappropriate. These results support the use of these criteria for the development of clinical guidelines or to determine the degree of appropriateness of cataract extraction for individual patients." (p.416)
Gutierrez et al[17] (2009) Spain	Change in visual acuity and in VF-14 scores by prioritization class (reference class: low), adjusted: Visual Acuity:	"…the scoring system we developed to prioritize patients for cataract extraction was able to identify patients with poorer VA and vision-related quality of life who were more

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	High: β=0.21 (p<0.0001) Intermediate: β=0.15 (p<0.0001) VF-14 Score: High: β=9.34 (p=0.001) Intermediate: β=10.90 (p=0.0003)	likely to experience greater benefit from cataract extraction, based on clinical and patient-centred outcomes. The use of this priority scoring system would provide a more rational way to prioritize patients on waiting lists for cataract extraction. In addition to being fairer, caring for high-priority patients first could improve the welfare of patients and the health system." (p.682)
Choi et al[18] (2009) Korea	Changes in outcome at 12 months by appropriateness criteria, mean (standard deviation) Visual acuity: Crucial: 0.75 (0.39)* Appropriate: 0.57 (0.51)* Uncertain: 0.13 (0.46) Inappropriate: 0.23 (0.19) F-test (ANOVA), p<0.001 VF-14: Crucial: 35.22 (22.86)* Appropriate: 27.09 (22.38)* Uncertain: 11.01 (17.07) Inappropriate: 12.79 (26.83) F-test (ANOVA), p<0.001 Symptom score: Crucial: 6.31 (5.29)* Appropriate: 4.37 (4.98) Uncertain: 3.00 (5.38) Inappropriate: 2.82 (5.85) F-test (ANOVA), p=0.006 Satisfaction with vision: Crucial: 40.00 (34.34) Appropriate: 41.56 (28.18) Uncertain: 28.79 (18.67)	"The crucial or appropriate rating surgeries may indicate better outcomes than uncertain or inappropriate rating surgeries do. The appropriate rating surgeries were more closely related to functional outcome vision function, VF-14 and subjective outcome (satisfaction with vision) in postoperative 12 months than inappropriate rating surgeries." (p.368)

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	Inappropriate: 47.62 (28.39) F-test (ANOVA), p=0.226 Satisfaction with overall care: Crucial: -0.41 (15.29) Appropriate: 0.58 (15.72) Uncertain: -5.62 (15.35) Inappropriate: -2.14 (18.86) F-test (ANOVA), p=0.308 Self-reported health: Crucial: 12.50 (33.98) Appropriate: 13.78 (24.72) Uncertain: 3.41 (20.84) Inappropriate: 7.14 (24.86) F-test (ANOVA), p=0.416 In multiple linear regression analysis, there was a trend that the appropriate rated surgeries were related to the successful change of the vision function (2.29, p = 0.015) and satisfaction with vision (3.84, p = 0.014) in 12 month postoperative period. *Duncan test, significant with uncertain and inappropriate	
Lundstrom et al[19] (2006) Sweden	Mean percentage reduction on total indication score due to surgery, by indication group (range 1 to 4, with 1 being highest indication for surgery and 4 being the lowest): Group 1: First eye surgery: 58.8% Second-eye surgery/bilateral same-day: 72.3% Group 2: First eye surgery: 50.0% Second-eye surgery/bilateral same-day: 55.6% Group 3: First eye surgery: 33.3%	"The tool seems to be stable and reliable and neutral towards different examiners." (p.495) "The impact of surgery was higher for patients with stronger indications for surgery, according to the tool." (p.499) "Ophthalmic clinics have also been advised not to operate on patients in the weakest indication group (IG 4), at least during the initial phase of the Maximum Waiting Time Guarantee, which started on 1st November 2005. The IG is now included in the data on all cataract extractions in Sweden that are

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	Second-eye surgery/bilateral same-day: 50.0% Group 4: First eye surgery: 37.5% Second-eye surgery/bilateral same-day: 16.7% Mean indication scores before/after surgery, by indication group: Group 1: Visual acuity* in surgery eye: 2/0 Visual acuity* in fellow eye: 1/0 Difficulties in daily life: 2.92/1.92 Cataract symptoms: 3.4/1.71 Independence:2.96/1.0 Group 2: Visual acuity* in surgery eye: 1/0 Visual acuity* in fellow eye: 0/0 Difficulties in daily life: 2.54/1.85 Cataract symptoms: 3.07/1.69 Independence: 2.15/1.09 Group 3: Visual acuity* in surgery eye: 1/0 Visual acuity* in fellow eye: 0/0 Difficulties in daily life: 1.88/1.73 Cataract symptoms: 1.89/1.69 Independence: 0.85/1.0 Group 4: Visual acuity* in surgery eye: 1/0 Visual acuity* in fellow eye: 0/0 Difficulties in daily life: 0.98/1.42	routinely collected by the Swedish National Cataract Register." (p.500)

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	Cataract symptoms: 0.85/1.00 Independence: 0.0/0.2 *median scores	
Guidelines		
American Academy of Ophthalmology [22] (2011)	"3. The decision to recommend cataract surgery should be based on consideration of the following factors: visual acuity, visual impairment, and potential for functional benefits. (strong recommendation, good evidence)" (p.4)	"There is no single test or measure that adequately describes the effect of a cataract on a patient's visual status or functional ability. Therefore, no single test can properly define the threshold for performing cataract surgery. Though various methods of visual acuity have long been considered the primary determinant for surgical appropriateness, the decision to recommend cataract surgery should not be made solely on this basis." (p.4)
Royal College of Ophthalmologists[23] (2010)	**"4.6 Diagnosis and Evaluation of visual impairment** • A detailed visual history should be taken, in particular establishing near and distance vision and past history of eye disease, binocular function and amblyopia. • The impact of cataract on the patient's lifestyle should be evaluated but it is important to realise that patients adapt to their visual impairment. (There is no single test to assess the effect of cataract on a patient nor is there a test to decide a threshold for surgery.) Questionnaires can be helpful in eliciting symptoms but should be used in conjunction with history taking and examination when deciding on surgery. • A full medical history should be taken with particular emphasis on drugs that may increase the risk of surgery (eg Tamsulosin Hydrochloride, other alpha-antagonists and anticoagulants12,13,14) and medical conditions that may make positioning or lying supine difficult .	Specific conclusion(s) not provided

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	4.7 Ophthalmic Examination A complete ophthalmic examination should include: • measurement of visual acuity (an up to date refraction should be available as part of the optometrist's report) • pupil examination • external eye examination including lids and lashes. • measurement of intraocular pressure • full slit lamp examination • dilated examination of the cataract and fundus • biometry • if indicated, photokeratometry" (p.11)	
Canadian Ophthalmological Society[4] (2008)	"2. Cataract surgery is indicated primarily for the correction of visual impairment that cannot be adequately improved non-surgically and that is directly attributable to the presence of a lens opacity [Level 3]" (p.S9) "3. Even in the absence of functional symptoms, cataract surgery is indicated to meet visual acuity standards when a patient's visual acuity falls below legal standards for activities (such as driving, military service, or flying) and the patient wishes to continue to perform these activities [Consensus]" (p.S9) "5. Cataract Surgery is indicated for medical reasons, such as phacomorphic glaucoma, lens-induced uveitis, or treatable posterior segment pathology, that cannot be adequately managed due to lens opacity [Consensus]" (p.S10) "6. Cataract surgery should be performed within four [Consensus] to six [Level 3] months of specialist consultation to minimize the risk of falls, fractures, and motor vehicle accidents. In jurisdictions where this cannot be accomplished, in addition to attempting to shorten wait times by procuring more resources, consideration should be given to a prioritization scheme to allow patients who are more at risk to be triaged [Consensus]" (p.S10) "7.The ophthalmic work-up of a patient being considered for cataract surgery should answer the following questions:	Specific conclusion(s) not provided

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	a) Is the cataract primarily responsible for the vision loss? b) Are there any comorbid conditions that may be exacerbated by the surgery? c) Are there any comorbid conditions that may complicate the execution of the surgery or minimize the visual improvement? Answering these questions allows the stratification of surgical risk that should be presented to the patient as part of the consent process [Level 3]" (p.S10-S11)	

AUC: area under the curve; CCPS: Catalan Agency for Health Technology Assessment and Research Cataract Priority System; CI: confidence interval; MCID: Minimal clinically important difference; OR: odds ratio; r: correlation coefficient; RCT: randomized controlled trial; VA: visual acuity; VF: visual function; WCWL: Western Canadian Waiting List