The need for cataract surgery: projections based on lens opacity, visual acuity, and personal concern

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Abstract

***Aim*—To assess the projected needs for cataract surgery by lens opacity, visual acuity, and patient concern.**

***Methods*—Data were collected as part of the Melbourne Visual Impairment Project, a population based study of age related eye disease in a representative sample of Melbourne residents aged 40 and over. Participants were recruited by a household census and invited to attend a local screening centre. At the study sites, the following data were collected: presenting and best corrected visual acuity, visual fields, intraocular pressure, satisfaction with current vision, personal health history and habits, and a standardised eye examination and photography of the lens and fundus. Lens photographs were graded twice and adjudicated to document lens opacities. Cataract was defined as nuclear greater than or equal to standard 2, 4/16 or greater cortical opacity, or any posterior subcapsular opacities.**

***Results*—3271 (83% response) people living in their own homes were examined. The participants ranged in age from 40 to 98 years and 1511 (46.2%) were men. Previous cataract surgery had been performed in 107 (3.4%) of the participants. The overall prevalence of any type of cataract that had not been surgically corrected was 18%. If the presence of cataract as defined was considered the sole criterion for cataract surgery with no reference to visual acuity, there would be 309 cataract operations per 1000 people aged 40 and over (96 eyes of people who were not satisfied with their vision, 210 eyes of people who were satisfied with their vision, and three previous cataract operations). At a visual acuity criterion of less than 6/12 (the vision required to legally drive a car), 48 cataract operations per 1000 would occur and people would be twice as likely to report dissatisfaction with their vision.**

***Conclusions*—Estimates of the need for cataract surgery vary dramatically by level of lens opacity, visual acuity, and patient concern. These data should be useful for the planning of health services.**

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We have shown previously that the volume of cataract surgery in Australia increased 2.6 times in the years 1985 to 1994.[1] The exact cost of cataract surgery in Australia is unknown but estimates for the USA for the year 1991 were $3.4 billion for typical cases[2] and costs are likely to rise in the USA and in other developed countries to meet increases in the demand for cataract surgery concomitant with the relative aging of the populations. A decrease in the threshold visual acuity for cataract surgery has been shown in the UK to double the number of people potentially eligible for cataract surgery,[3 4] thus doubling the costs. The Preferred Practice Pattern of the Royal Australian College of Ophthalmologists for cataract surgery states that the "indications for surgery are dependent on various levels of visual impairment and cataract surgery is justified and appropriate when the subjective, objective, and education criteria are met", but does not have a visual acuity threshold at which cataract surgery is not advised.[5] There has also been much discussion about the relative merit and cost of second eye cataract surgery.[6 7]

The influence of visual acuity, visual function, and surgeon on the demand for cataract surgery has been studied in a number of countries, with the general conclusion that functional impact and concern, not surgeon preference or visual acuity, are the major determinants of demand.[8–11] The purpose of this study was to predict the number of cataract operations per 1000 people at risk that may be needed in Australia (and similar countries) by level of visual acuity and patient concern. These data will be useful for healthcare administrators to estimate demand for cataract services.

Methods

STUDY POPULATION

Details of the Melbourne Visual Impairment Project methodology have been published previously.[12] In brief, nine pairs of census collector districts from the Melbourne Statistical Division were randomly selected from which to recruit residents who had resided in their homes for at least 6 months to attend a local screening centre.

STUDY PROTOCOL

Procedures at the local screening centre included assessment of presenting and best corrected distance visual acuity,[13] reading vision, visual fields, intraocular pressure, fundus and lens photography, a standardised clinical slit lamp examination, a detailed interview about medical history and personal health habits. People were asked to rate their personal satisfaction with their current vision (with

glasses if used) as very dissatisfied, dissatisfied, satisfied or very satisfied. These responses were then classified in to the two categories of "dissatisfied" or "satisfied" for the analyses. All participants gave written informed consent and the study protocol was approved by the Royal Victorian Eye and Ear Hospital human research ethics committee.

Lens opacities were graded clinically at the time of the examination and subsequently from photos using the Wilmer cataract photo grading system.[14] Cortical opacities were assessed with retroillumination and measured as the proportion in 16ths of pupil circumference occupied by opacity. For these analyses, cortical cataract is defined as 4/16 or greater opacity. The area of posterior subcapsular (PSC) opacities was measured in square millimetres. The presence of any PSC opacity was classified as cataract. Nuclear opacities were compared against four standard photographs and decimalised. For these analyses, nuclear cataract was defined as opacity equal to or greater than standard photo 2. These definitions of cataract are similar to what has been used in previous population based studies.

A Topcon SL5 photo slit lamp with a 0.1 mm slit beam of 9.0 mm in height set to an incident angle of 30° and Ektachrome 200 ASA colour slide film were used to photograph nuclear opacities. Cortical and PSC opacities were photographed with an Oxford retroillumination camera and T-Max 400 film.

All of the photos were graded independently by two trained research assistants and discrepancies were adjudicated by the ophthalmic research fellow. With the exception of ungradable or missing photos, the photo grades were used for analyses.

DATA MANAGEMENT

Interview data were entered directly into the computer. All other data were entered twice and verified. Analyses were performed in SAS Version 6.10 (SAS Institute Inc, Cary, NC, USA) and are documented in the SAS procedure manuals. A p value <0.05 was considered to be statistically significant. χ^2 analyses were employed to evaluate significant univariate relation among categorical variables while backwards logistic regression was used to assess the independent effect of categorical variables in multivariate models.

Results

STUDY POPULATION

A total of 3271 eligible (83%) residents participated. The only significant difference between attenders and non-attenders was language spoken at home; non-attenders were more likely to be non-English speakers.[15] The following variables were used to compare participants and non-participants and participants with the census data from the Australian Bureau of Statistics: age, sex, education, ethnicity. The study cohort has been shown to be representative of all Melburnians aged 40 and up.[15] The participants ranged in age from 40 to 98 years (mean 58.7, SD 11.4) and 1511 (46.2%) were men. Photos were used to classify cortical and PSC opacities in 2919 (90%) right eyes and 2891 (89%) left eyes. Photos were used to classify nuclear cataract in 2969 (92%) right eyes and 2957 (91%) left eyes. All available data are employed for each separate analysis.

CATARACT PREVALENCE

The overall prevalence of any type of cataract that had not been surgically removed was 18%. The age and sex specific cataract status of each eye reveals the dramatic increase in cataract and cataract surgery with each decade of life (Table 1). Previous cataract surgery had been performed in 107 (3.4%) of the participants; of the 103 with available information on their cataract surgery, 18% had occurred in the previous year. Controlling for age, women were significantly more likely to have cataract than men (OR=1.45, 95%CL=1.18, 1.78).

RELATION OF LENS OPACITIES TO VISUAL ACUITY AND PERSONAL SATISFACTION WITH VISION

People who were dissatisfied with their vision were more likely to have cataract (χ^2, 1 df =22.0, p=0.001) and this was true at nearly all levels of best corrected visual acuity. It is interesting to note that 462 of 2300 (11.9%) people with 6/6 or better visual acuity reported dissatisfaction with their vision and that for the majority of these people, their dissatisfaction would not be attributed to cataract.

A backwards multivariate logistic regression model was fitted to predict dissatisfaction with current vision. The following variables were included as potential predictors: 10 year age group, lines of best corrected visual acuity (Snellen equivalent from logMAR), presence

Table 1 Prevalence of cataract and previous cataract surgery by age and sex*

Age	*Sex*	*No cataract in either eye*	*Prevalent cataract in one eye only*	*Prevalent cataract in both eyes*	*Prevalent cataract in one eye, previous surgery in 2nd eye*	*Previous surgery in one eye, no cataract in 2nd eye*	*Previous surgery in both eyes*
40–49	Men, n=352	339 (96.3%)	8 (2.27%)	1 (0.26%)	0 (0%)	3 (0.85%)	1 (0.28%)
	Women, n=459	447 (97.4%)	10 (2.18%)	2 (0.44%)	0 (0%)	0 (0%)	0 (0%)
50–59	Men, n=442	406 (91.9%)	24 (5.4%)	9 (2.04%)	2 (0.45%)	0 (0%)	1 (0.23%)
	Women, n=524	489 (93.3%)	20 (3.82%)	12 (2.29%)	2 (0.38%)	0 (0%)	1 (0.19%)
60–69	Men, n=423	331 (78.3%)	35 (8.27%)	49 (11.6%)	3 (0.71%)	1 (0.24%)	4 (0.95%)
	Women, n=429	304 (70.9%)	53 (12.4%)	61 (14.2%)	4 (0.93%)	2 (0.47%)	5 (1.17%)
70–79	Men, n=218	117 (53.7%)	22 (10.1%)	61 (28.0%)	6 (2.75%)	2 (0.92%)	10 (4.59%)
	Women, n=220	87 (40.0%)	33 (15.0%)	86 (39.1%)	6 (2.73%)	2 (0.91%)	6 (2.73%)
80–89	Men, n=56	12 (21.4%)	8 (14.3%)	22 (39.3%)	7 (12.5%)	1 (1.79%)	6 (10.7%)
	Women, n=86	4 (4.65%)	7 (8.14%)	51 (59.3%)	10 (11.6%)	2 (2.33%)	12 (14.0%)
90+	Men, n=3	0 (0%)	0 (0%)	3 (100%)	0 (0%)	0 (0%)	0 (0%)
	Women, n=12	0 (0%)	1 (8.33%)	4 (33.3%)	2 (16.7%)	0 (0%)	5 (41.7%)
All ages	Total, n=3224	2536 (78.7%)	221 (6.85%)	361 (11.2%)	42 (1.3%)	13 (0.40%)	51

*Nuclear opacity ⩾ photo standard 2, ⩾ 4/16 cortical opacity, any PSC.

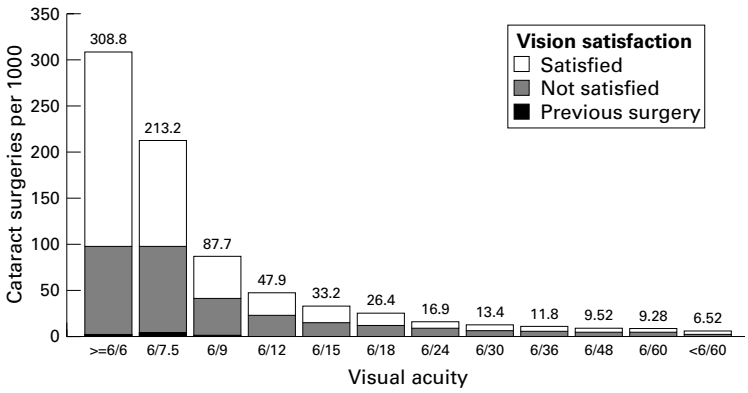

Figure 1 Cumulative number of cataract (defined as nuclear opacity ⩾ photo standard 2, ⩾ 4/16 cortical opacity or any posterior subcapsular opacities (PSC) operations required per 1000 population aged 40+ by level of best corrected visual acuity and patient satisfaction with vision.

of unoperated cataract, and sex. The only factors that remained in the model were best corrected visual acuity (OR=1.45 for each one line decrease, 95%CL=1.30, 1.61) and the presence of unoperated cataract (OR=1.24, 95%CL=1.001, 1.53).

The potential number of cataract operations needed per 1000 population aged 40 and over at risk varies dramatically by level of visual acuity and personal satisfaction with current vision (Fig 1). If visual acuity was not a criterion for number of cataract operations per 1000 population at risk aged 40 and over, the number of cataract operations would be 309 (96 eyes of people who are not satisfied with their vision, 210 eyes of people who are satisfied with their vision and three previous cataract operations). The total number of potential cataract operations decreases by one third by imposing a threshold of 6/7.5 visual acuity. By the level of <6/12 visual acuity (the vision required to legally drive a car), the total number of cataract operations per 1000 drops to 48 and people were twice as likely to report dissatisfaction with their vision. If the visual acuity required for a blind pension (<6/60) were imposed as a threshold for cataract surgery, only 6.5 operations per 1000 population would need to be performed.

Discussion

To our knowledge, this is the first population based estimate of the need for cataract surgery to consider lens opacity, visual acuity, *and* satisfaction with vision. We have shown that significant lens opacities are prevalent in the 40 and over age group and that both visual acuity and personal dissatisfaction with vision can be strong determinants of the potential need for cataract surgery in the community.

Our results confirm the results from studies conducted in the UK which have revealed that by decreasing the visual acuity threshold for cataract surgery, the estimated need for cataract operations increases dramatically.[3 4] However, it is equally important to consider the level of satisfaction with vision in conjunction with lens opacity and visual acuity as we have shown previously that the strongest predictor of referral for cataract surgery by Australian ophthalmologists is patient concern.[8]

The Royal Australian College of Ophthalmologists acknowledge that although "no single eye test adequately describes the effect of cataracts on a patient's visual status or functional ability", "simple Snellen visual acuity is the most universally used index of visual function". However, as we and other researchers have shown, visual acuity is not highly related to satisfaction with vision. A study of patients' perception of their need for cataract surgery conducted in Norway revealed that visual function and visual acuity were not highly correlated until visual acuity was less than 6/24 in the worse eye.[16] The VF-14,[17] an index of functional impairment in patients with cataract, has recently been used with cataract patients in the USA. Researchers have shown that the VF-14 is a better measure of improvement in visual function after cataract surgery than visual acuity.[18]

Another important reason to consider patient concern with vision simultaneously with visual acuity is the expected improvement in outcomes with cataract surgery. Several studies have now shown that visual function before surgery is the strongest predictor of visual outcome and quality of life after cataract surgery, independent of visual acuity.[19–22] This implies that if cataract surgery were advised solely on the basis of visual acuity, the change in satisfaction and visual outcome would not be as great. Our data support this hypothesis; at better levels of visual acuity, the majority of people are satisfied with their vision and would not be expected to benefit substantially from cataract surgery.

As cataract surgery improves, giving better visual results with fewer adverse reactions, the procedure is done for less severe visual impairment. Our data are consistent with a doubling of the need for cataract surgery with each two line change in visual acuity. The change from aphakic ICCE to ECCE/IOL was associated with a drop in the visual acuity threshold from 6/60 to 6/18. The use of phacoemulsification is now further lowering that threshold to 6/6, 6/7.5 or 6/9.

The level of lens opacity, visual acuity, and visual function all need to be considered in the recommendation of patients for cataract surgery. The establishment or enforcement of guidelines and thresholds for cataract surgery will have obvious implications for total costs to the community, the expected size of improvement in outcomes, the cost utility and cost effectiveness of the procedure, and the size of the waiting lists at public hospitals. The information from this study should assist in the planning of services to address the expected increase in demand for cataract surgery in developed countries.

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