Cataract surgery in New Zealand: access to surgery, surgical intervention rates and visual acuity
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ABSTRACT

AIMS: To analyse the surgical intervention rate (SIR), best spectacle-corrected visual acuity (BSCVA) and disparities in access to public-funded cataract surgery in New Zealand. The New Zealand Ministry of Health uses the National Prioritisation Web Service (NPWS) to prioritise all patients for public-funded cataract surgery. BSCVA at prioritisation, ethnic, demographic and geographic disparities have not previously been assessed.

METHODS: A retrospective cohort study. Between November 2014 and March 2019, 61,095 prioritisation events for 44,403 unique patients were identified. Cataract prioritisation events extracted from the NPWS were merged with date of birth and ethnicity extracted from the National Health Index database. All data were de-identified prior to statistical analysis.

RESULTS: Mean age at prioritisation was 74.4 years, with female preponderance (56%). Overall ethnicity was ‘European’ in 69.8% and ‘New Zealand Māori’ in 9.6%. Mean Snellen BSCVA was 6/30-2 (prioritised eye), and 6/12-1 (binocular). Māori and Pasifika presented on average 10 years earlier than other ethnic groups with significantly worse BSCVA. Surgery was approved in 74.4% of prioritisation events with mean Snellen BSCVA of 6/38-2. Only 34.9% of New Zealand patients had Snellen BSCVA of 6/12 or better in the prioritised eye, compared to 58.4% in the European Union. Cataract SIR varied by region.

CONCLUSIONS: New Zealand’s cataract SIR is lower than most Organisation for Economic Co-operation and Development countries and patients have significantly worse BSCVA at prioritisation. Access to cataract surgery in New Zealand varies according to region. Māori and Pasifika present younger with worse BSCVA, suggesting potential barriers in accessing timely referral and prioritisation.

Cataracts are the leading cause of vision impairment and blindness in the world.¹ In developed countries, cataract surgery is one of the most commonly performed elective surgical procedures.² Cataract surgery is associated with improvements in visual acuity, decreased risk of falls and improved quality of life.³⁻⁵ These benefits, coupled with an ageing population at high risk of cataract-related visual impairment, have increased the demand for cataract surgery worldwide.

With improvements in surgical capacity, recovery time, decreased complication rates and improved visual outcomes, the surgical intervention rate (SIR) for cataract surgery in most of the Organisation for Economic Co-operation and Development (OECD) countries has increased dramatically over the past two decades.² Government spending on cataract surgery typically produces a large return on investment,⁶ and the cost per quality-adjusted life year gained is one of the highest of any operation or medical intervention.⁵,⁶ Despite the significant benefits of cataract surgery, healthcare resources are finite and prioritisation for surgery is an important strategy to ensure that those with the greatest need are prioritised highest for surgery.
Public-funded cataract surgery accounts for approximately half of all cataract surgery currently completed in New Zealand. Eligibility for public-funded cataract surgery in New Zealand is assessed based on a weighted combination of visual acuity, cataract morphology and patient-reported quality of life. These variables are combined to produce a Clinical Prioritisation and Assessment Criteria (CPAC) score that ranges from 0 to 100 points. District health boards (DHBs) each set their own regional CPAC threshold based on demand and available funding for cataract surgery. To be prioritised for publicly funded cataract surgery a patient needs to score above the CPAC threshold in their region. CPAC thresholds may change over time in response to a number of factors and are not typically published; however, a 2019 report documented that the nationwide CPAC thresholds ranged from 40 to 61 in 2018. The New Zealand Ministry of Health provides access to the National Prioritisation Web Service (NPWS) to calculate the CPAC score, assess eligibility, and to identify those patients who will benefit most from surgery. The prioritisation system allows for clinical overrides to prioritise patients who have cataract that makes it difficult to monitor AMD, glaucoma or diabetic eye disease. For these patients at risk of permanent visual loss, prioritisation is assured and visual acuity and quality of life data is optional.

The lack of a single nationwide CPAC threshold for cataract surgery in New Zealand may introduce disparities in access to surgery. The demographic and ethnic composition of the New Zealand population varies from region to region. Certain demographic subgroups, including New Zealand Māori and Pasifika ethnicity, may experience barriers in accessing healthcare, and commonly endure worse health outcomes. Until now, the impact of regional prioritisation thresholds on ethnic and demographic disparity in accessing public-funded cataract surgery has not been assessed.

This study aims to investigate the characteristics of all patients referred for public-funded cataract surgery in New Zealand and to provide a nationwide overview of access to cataract surgery in New Zealand.

Methods

This study conformed to the tenets of the Declaration of Helsinki and the National Ethics Advisory Committee guidelines. Criteria for exemption from formal review by the New Zealand Health and Disability Ethics Committee was met. This is a retrospective cohort study analysing all patients referred for cataract surgery in the New Zealand public healthcare system between November 2014 and March 2019.

National prioritisation data for cataract surgery were extracted from the New Zealand Ministry of Health NPWS database. Clinical variables included best spectacle corrected visual acuity (BSCVA) in the eye prioritised for surgery alone and with both eyes open, cataract morphology, clinician-estimated visual potential, patient-reported impact on life and DHB of domicile. Using the National Health Identifier (NHI) as a primary key, date of birth, gender and patient-reported ethnicity data were merged to all prioritisation events for analysis. Age at prioritisation was calculated as the difference in years between the date of birth and the date of prioritisation. All data were de-identified prior to analysis.

New Zealand national census data were used to normalise regional prioritisation events by gender, age, ethnicity, location and duration of data collection to enable comparison between regions. OECD cataract surgery data were used to compare New Zealand prioritisation for cataract surgery rates with cataract surgery rates in other OECD countries.

All patients prioritised for publicly funded cataract surgery in New Zealand using the Ministry of Health Web Service between November 2014 and March 2019 were included in this study. Where a clinician, on the same day, submitted more than one prioritisation event for the same patient with differing clinical variables (a same-day re-prioritisation event), the number of events submitted and patient ethnicity were analysed. Same-day re-prioritisation events were excluded from further analysis. Visual acuity was converted to LogMAR units for statistical analysis, which was completed using R statistical software (R Foundation for Statistical Computing, Vienna, Austria).
Results

A total of 61,095 prioritisation events involving 44,403 unique patients, spanning 52 months from November 2014 to March 2019, were identified for analysis. Two thousand four hundred and twenty-eight prioritisation events were identified as duplicates or had incomplete data submitted (in the case of overrides), and were removed from analysis. Two patients did not have ethnicity coded and were excluded from analysis that included ethnicity-related endpoints.

The mean age at prioritisation was 74.5 years for females and 73.7 years for males, with a female preponderance (56.0%). Of all prioritisation events, the mean Snellen BSCVA was 6/30-2 for the prioritised eye, and 6/12-1 binocular. For females and males, BSCVA in the prioritised eye was 6/30-1 and 6/38+2 respectively, and binocular BSCVA was 6/12-2 and 6/12-1 respectively. BSCVA in both the prioritised eye and binocular was similar across the regions. Surgery was approved in 72.6% of all prioritisation events. After removing duplicates, clinical overrides and same-day re-prioritisation events, surgery was approved in 74.4% of prioritisation events with mean LogMAR BSCVA 0.84 (6/38-2 Snellen equivalent, prioritised eye). Of all prioritisation events approved for surgery, 34.9% had LogMAR BSCVA 0.3 (6/12 Snellen equivalent, prioritised eye) or better.

Self-reported ethnic origins were ‘European’ in 69.8% and ‘New Zealand Māori’ in 9.6% of all prioritisation events, with other ethnic minorities comprising the remainder. Ethnicity, mean age and visual acuity of all prioritisation events that were made once on a given day are presented in Table 1. Where patients had same-day re-prioritisation events, the initial visual acuity submitted was used for analysis. The ethnicity of all patients prioritised is not significantly different to the proportions seen in the wider population of New Zealand (Chi squared = 20, degrees of freedom = 16, P-value = 0.22). The visual acuity differed between ethnic groups (Kruskal-Wallis p-value <0.001) with the worst mean LogMAR visual acuity noted for New Zealand Māori and Pasifika ethnic groups.

New Zealand Māori and Pasifika were also noted to have younger mean age at prioritisation than other ethnic groups. Age at prioritisation stratified by ethnicity is shown in Figure 1. Analysis of variance confirmed a statistically significant difference between different ethnic groups (P-value <0.001).

There were a total of 1,954 patients who were prioritised by the same clinician more than once on the same day, with different values submitted in each prioritisation event (Table 2). The ethnicity of patients with same-day re-prioritisation events is not significantly different to the proportions seen in the wider population (Chi squared = 20, degrees of freedom=16, P-value = 0.22).

Table 1: Ethnicity, mean age and visual acuity of prioritisation events compared with the New Zealand population.

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Number of patients' (percentage)</th>
<th>Percentage of NZ population</th>
<th>Mean age (years)</th>
<th>Mean BSCVA prioritised eye (Snellen)</th>
<th>Binocular mean BSCVA (Snellen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>European</td>
<td>39,467 (69.6%)</td>
<td>65.7%</td>
<td>77.0</td>
<td>6/30+1</td>
<td>6/12-1</td>
</tr>
<tr>
<td>Asian</td>
<td>5,735 (10.1%)</td>
<td>10.4%</td>
<td>70.3</td>
<td>6/38+2</td>
<td>6/12-2</td>
</tr>
<tr>
<td>NZ Māori</td>
<td>5,460 (9.6%)</td>
<td>13.3%</td>
<td>69.5</td>
<td>6/60+2</td>
<td>6/12</td>
</tr>
<tr>
<td>Pasifika</td>
<td>4,410 (7.8%)</td>
<td>6.6%</td>
<td>68.0</td>
<td>6/45</td>
<td>6/12-1</td>
</tr>
<tr>
<td>Other</td>
<td>1,641 (2.9%)</td>
<td>4.0%</td>
<td>73.2</td>
<td>6/30-2</td>
<td>6/12-1</td>
</tr>
<tr>
<td>Total</td>
<td>56,713</td>
<td>74.4</td>
<td></td>
<td>6/30-2</td>
<td>6/12-1</td>
</tr>
</tbody>
</table>

†There were a total of 44,403 unique patients. Some patients included in this summary were prioritised more than once on a different day, eg, for second eye surgery.

BSCVA = best spectacle corrected visual acuity.
Prioritisation events were compared by region after controlling for age, gender, ethnicity and catchment population size (Figure 2). This data includes prioritisation events both above and below eligibility threshold. Prioritisation events that were approved for public-funded cataract surgery were compared by region after controlling for age, gender, ethnicity and catchment population size (Figure 3).

The percentage of referrals declined by each DHB varied significantly (Figure 4). Three DHBs declined over 40% of referrals received. Based on the number of referrals made to each DHB, Lakes DHBs had the lowest approval rate of 51.4% and West Coast DHB had the highest approval rate of 93%.

Although the mean BSCVA of all patients that were prioritised for surgery were comparable across the regions, the variation was significant. Analysis of variance demonstrates a statistically significant difference between the mean age at prioritisation between different ethnic groups (P-value <0.001).

Table 2: All prioritisation events grouped by the number of same-day prioritisation events.

<table>
<thead>
<tr>
<th>Number of same-day prioritisation events</th>
<th>Number of patients†</th>
<th>Total number of prioritisation events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>56,713</td>
<td>56,713</td>
</tr>
<tr>
<td>2</td>
<td>1,617</td>
<td>3,234</td>
</tr>
<tr>
<td>3</td>
<td>248</td>
<td>744</td>
</tr>
<tr>
<td>4</td>
<td>61</td>
<td>244</td>
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<tr>
<td>5</td>
<td>18</td>
<td>90</td>
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<td>6</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>24</td>
</tr>
</tbody>
</table>

†A number of the 44,403 unique patients will have also been scored on a different day, eg, for second eye surgery; these patients will therefore be represented more than once in this table.
Figure 2: Total number of prioritisation events, including those approved and declined for public-funded cataract surgery by district health board (DHB). Results are adjusted for age, gender, ethnicity and DHB catchment population size, with blue dots representing unadjusted rates. The nationwide mean overall number of prioritisation events (459/100,000/year) is indicated by the horizontal line.

Figure 3: Number of approved prioritisation events per year by each district health board (DHB). Results are adjusted for age, gender, ethnicity and DHB catchment population size, with green dots representing unadjusted rates. The nationwide mean overall number of approved prioritisation events (340/100,000/year) for public-funded surgery is indicated by the horizontal line.
Figure 4: The percentage of prioritisation events declined by district health boards throughout New Zealand. The national percentage of declined prioritisation events (25.6%) is indicated by the horizontal line.

Figure 5: Number of declined referrals by district health boards. Bars are colour coded according to the proportion of patients in each visual acuity group in the prioritised eye (upper plot), or both eyes (lower plot). Red bars indicate patients with visual acuity worse than 6/24, orange bars indicate patients with visual acuity worse than 6/12, yellow bars indicate visual acuity better than 6/12.
binocular BSCVA of patients declined for cataract surgery varied significantly (range 6/6 to 6/36 Snellen, summarised in Figure 5). In total, 27.7% of all declined prioritisation events had binocular BSCVA 6/12 Snellen or worse, and 8.6% had BSCVA 6/15 Snellen or worse. The majority of all declined patients with a binocular BSCVA of 6/12 Snellen or worse were from the Waikato and Bay of Plenty DHB regions; however, per population, the highest rates were seen in Southern and Nelson-Marlborough DHBs. Overall, 0.3% of declined patients had binocular BSCVA worse than 6/24 Snellen from seven different DHBs.

The patient-reported quality of life score used for prioritisation was calculated from the Patient Impact on Life Questionnaire, which is assigned by the Ministry of Health to all elective surgical prioritisation schemes. This questionnaire is explained in detail elsewhere.14

Discussion

The current study assessed access to public-funded cataract surgery in New Zealand. Regional differences in mean patient characteristics and disparity in access to surgery between DHBs were identified. These findings highlight inequity in access to elective cataract surgery, a finding that is consistent with reports evaluating access to surgery in other specialties in New Zealand.15,16

The age and gender of patients prioritised for cataract surgery in New Zealand were similar to rates seen in other OECD countries.17–19 The visual acuity of patients prioritised for surgery in New Zealand was significantly worse than vision at the time of surgery in other OECD countries.19,20 The nationwide mean BSCVA of 6/30 (prioritised eye) at the time of prioritisation indicates that a significant level of visual impairment is required to access public-funded surgery in New Zealand. New Zealand Māori and Pasifika ethnic groups have worse visual acuity, and typically severe visual impairment, compared with other ethnic groups at the time of prioritisation. These ethnic disparities are consistent with reports from other specialties of the New Zealand health system and highlight the urgent need to improve access and the provision of culturally appropriate services for these ethnic groups.21,22

Despite the significantly worse visual acuity at prioritisation noted for New Zealand Māori and Pasifika, the proportion of prioritisation events for these ethnic groups was not significantly different to their proportion in the wider population of New Zealand. New Zealand Māori and Pasifika patients who were prioritised for cataract surgery, however, were on average 8–9 years younger than other ethnic groups and 6–7 years younger than the national mean. These results demonstrate that New Zealand Māori and Pasifika patients develop more advanced cataract associated with a greater degree of visual impairment at a younger age. New Zealand Māori and Pasifika patients face barriers to accessing timely referral for cataract surgery. As a result of severe visual impairment, these patients will, in many cases, have significantly decreased quality of life, increased risk of falls and decreased independence while waiting for treatment.3,23,24

The ethnic distribution of same-day re-prioritisation events did not differ significantly in comparison to the wider New Zealand population. Data for same-day re-prioritisation events did not include a reason for this activity. It is possible clinicians re-prioritised due to data-entry errors or in some cases clinicians may have intentionally re-scored patients who did not initially meet the threshold for surgery.

The overall mean Snellen visual acuity for prioritisation events accepted for cataract surgery in New Zealand is 6/38-2, significantly worse than the visual acuity reported in most OECD countries at the time of surgery. The 2018 Euroquvo report that has data for over 2.8 million cataract surgeries completed in the European Union, reports 58.4% of European cataract surgery patients have visual acuity of 6/12 or better in the operated eye at the time of surgery.20 Canadian guidelines recommend cataract surgery when the visual acuity decreases to 6/15 in the operative eye, or 6/12 with symptoms of glare, and/or anisometropia.25 In contrast, only 34.9% of New Zealand patients in the current study had visual acuity of 6/12 or better in the operative eye at the time of prioritisation.
The current study noted that 25.6% of prioritisation events for public-funded cataract surgery were declined with significant regional variation noted. The lack of a single national CPAC threshold for public-funded cataract surgery, which ranged between 40–61 in 2018, creates significant geographic disparity in access. Over one quarter of patients who were declined for surgery did not meet the visual acuity requirement for driving a private vehicle in New Zealand. Although it is not possible to exclude the presence of visual comorbidities from data analysed in the current study, a small but significant number of patients who were declined for public-funded surgery had such advanced visual impairment they would be eligible for registration with Blind Low Vision New Zealand (formerly the Blind Foundation). The difference between declined rates based on the prioritised eye BSCVA and binocular BSCVA suggests that most prioritisation events that were declined were prioritisation events for second eye surgeries.

Although the mean BSCVA of all prioritisation events for public-funded cataract surgery in New Zealand were comparable across the regions, the SIR varied significantly from 95 to 737/100,000 population/year, with the Auckland region SIR more than double the national mean. Other OECD countries with regional variations in SIR have proposed that this could be due to regional variation in the indication for surgery, or related to ocular health provider proximity; these studies however, reported SIR in isolation without reporting regional variations in BSCVA so further analysis is not possible. In the current study, the reason for geographic disparity in access to cataract surgery is the lack of a single national CPAC threshold.

The mean overall SIR for cataract surgery in New Zealand is lower than most OECD countries. Canada and Australia have cataract SIR's in excess of 1,000/100,000 population/year, over double the current rate in New Zealand even after adjusting for private surgery volumes. The cataract SIR in the UK public-funded National Health Service has been over double the rate of public-funded surgery in New Zealand since 2014. Comparing with other OECD countries that have a similar ratio of gross domestic product to health spending to that of New Zealand, in 2018 New Zealand ranked 23 out of 27 for cataract SIR. The total New Zealand government spend on healthcare (7.5% of GDP) was ranked 14 out of 27 OECD countries. New Zealand has relatively high rates of certain cancers, obesity and obesity-related chronic illnesses that may limit funding elsewhere.

There are several limitations to the current study. The data includes only patients referred for public-funded cataract surgery and does not include data for surgery completed in the private healthcare sector. Visual acuity data were rounded to the nearest line at the time of prioritisation and may contain rounding errors in some cases. It is possible that a small number of patients who received public-funded cataract surgery may not have been prioritised prior to surgery and will not have been recorded in the current data set. Some patients who were prioritised for surgery may not have undergone surgery if for some reason they declined treatment.

Cataract surgery is relatively inexpensive with significant economic and quality of life benefits. Visual impairment contributes to poor quality of life, falls, depression and loss of independence. This is the first study reporting nationwide prioritisation for public-funded cataract surgery in New Zealand spanning a period of four years. New Zealand Māori and Pasifika patients prioritised for public-funded cataract surgery are typically younger and have significantly worse vision than other ethnic groups. Regional variation in CPAC thresholds creates significant geographic disparity for patients in New Zealand who have cataracts to access public-funded surgery. Given the well-established return on investment and dramatic improvement in quality of life associated with cataract surgery, increasing the cataract SIR to match other OECD rates, introducing a single national CPAC threshold, and improving access for New Zealand Māori and Pasifika would provide significant benefits for the New Zealand population.
REFERENCES:


