

Original Article

Cataract in indigenous Australians: the National Indigenous Eye Health Survey

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ABSTRACT

Background: To determine the prevalence of vision loss due to cataract in indigenous Australians.

Methods: A national, stratified, random cluster sample was selected in 30 communities across Australia. Data collection was undertaken in 2008. Adults 40 years and older were examined using a standardized protocol that included a questionnaire. The presence of visually significant cataract was assessed.

Results: Response rates were good and 1189 indigenous adults were examined and overall recruitment was 72%. Low vision (<6/12–6/60) due to cataract occurred in 2.52% (1.63–3.41%) and blindness (<6/60) in 0.59% (95% CI: 0.24–1.21%). The cataract coverage rate (proportion of those with visually significant cataract who had been operated on) was 65.3% (95% CI: 55.0–74.6%). Projections suggest that there are 3234 indigenous adults with vision loss from cataract.

Conclusions: Cataract remains a major cause of vision loss in Aboriginal and Torres Strait Islander peoples. There were no significant regional or state differences in the prevalence of cataract or of cataract surgical coverage, which suggests that increased cataract surgery services are required across the country to address cataract in indigenous Australians.

Key words: cataract, indigenous Australians, vision loss.

INTRODUCTION

Cataract is the leading cause of blindness in developing countries.¹ It was also the leading cause of blindness in developed countries half a century ago² but developments both in cataract surgery and in access to services have made blindness from cataract almost a thing of the past for a developed country like Australia where an estimated 200 000 cataract operations are now performed each year.^{3,4} In Australia, cataract causes 27% of visual impairment and 14% of blindness.³

Previous reports have inferred higher rates of vision loss and blindness for cataract in Aboriginal and Torres Strait Islander people than in other Australians.^{5,6} Although high rates of cigarette smoking and high ocular exposure to ultraviolet-B radiation may contribute to a somewhat higher rate of cataract in indigenous people in Australia, difficulties in accessing cataract surgery services also play a significant role. However, there are neither recent reports that document the prevalence of vision loss due to cataract in indigenous Australians nor the adequacy and coverage of cataract surgery services.

This paper reports the prevalence of vision-impairing cataract in a national population-based, random cluster sample survey of vision and eye health in indigenous older adults. It highlights the need for the better provision of cataract surgery to help close the gap in eye health between indigenous and other Australians.

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METHODS

Sample size

The sampling method used in the National Indigenous Eye Health Survey (NIEHS) has been described in detail elsewhere.⁷ Briefly, the sample sites were randomly selected using the Accessibility and Remoteness Index (ARIA) strata;⁸ Major city, inner regional, outer regional, remote and very remote with a division of the very remote stratum into very remote coastal and very remote inland. Using 2006 census data,⁹ Census collection districts or statistical local areas were randomly selected from the six strata to give survey sites defined geographically to encompass about 300 indigenous people.

The process for obtaining ethical clearance for the NIEHS has been described in detail elsewhere.^{10,11} Primary ethical approval was obtained from the Human Research Ethics Committee of the Royal Victorian Eye and Ear Hospital and separate formal ethical approval was obtained from the appropriate jurisdictional bodies and communities. This research was conducted in accordance with the tenets of the Declaration of Helsinki as revised in 2000. Written, informed consent was obtained for all participants before examination.

Recruitment

The recruitment strategies used varied with local conditions and whenever possible, worked closely with the Aboriginal Medical Services. An informal census was made using all available community data to establish the number of eligible indigenous adults aged 40 and above.¹²

Examination procedures

A standardized questionnaire was used to collect data on demographics, general health, eye health and health service utilization.⁷ Questions were asked about a previous diagnosis of cataract and whether cataract surgery had been undertaken. A standardized eye examination included presenting distance and near visual acuity using a handheld tumbling E chart recommended by World Health Organization¹³, visual field testing, trachoma grading and retinal photography.

When the vision in an eye was worse than 6/12, an anteriorly focused retro-illumination photograph of the lens was also taken to assess the presence of cataract.¹⁴ If an adequate retinal photograph could not be obtained, appropriate dilating drops were used. On the completion of the examination, for those people who required further attention, arrangements were made for the appropriate treatment or referral.

Cataract, or vision-impairing cataract, was defined as the presence of lens opacities that were assessed as being the cause of vision loss in eyes with a visual acuity of less than 6/12.

Vision impairment refers to all those with vision loss less than 6/12; low vision to those with vision less than 6/12 but better than or equal to 6/60; blindness refers to those with vision less than 6/60.

Data analysis

Data were entered into an electronic database using Access Software (Microsoft Corporation, Redmond, WA, USA). Data cleaning and analyses were performed with Stata version 10.2 (Stata Corporation, College Station, TX, USA). Differences between remoteness regions and states were examined using χ^2 Pearson's tests for categorical data (Fisher test for stratified samples less than five), and ANOVA or Kruskal–Wallis for continuous data (as appropriate for distribution). A *P*-value of less than 0.05 was considered significant. Victoria (*n* = 29) and Tasmania (*n* = 43) were excluded from state-stratified analysis due to the small sample sizes.

RESULTS

The target population of indigenous adults over the age of 40 was 1655 of whom 1189 (72%) were examined. Data on presenting visual acuity were missing for six indigenous adults, all of whom were believed to have normal vision.

History of cataract

Overall, 145 adults (12.0%, 95% confidence interval [CI]: 10.4–14.2%) recalled having been told that they had cataract. Of these, 65 (44%) were found to be phakic with vision of 6/12 or better and 13 (19%) people were phakic but had vision loss due to other causes; refractive error (seven), diabetic eye disease (four), age-related macular degeneration (one) and retinitis (one). These findings suggest poor recall, misdiagnosis or lack of question specificity. There was no gender difference in the recall of a past history of cataract, although more women (28%) than men (19%) recalled having a family history of cataract ($\chi^2 = 12.8$, *P* < 0.001).

Another 69 people (48%) reported having had cataract surgery on at least one eye. However, of these five were found not to have had surgery and were phakic in each eye. Of the 67 people who gave a history of cataract and decreased vision but who had not yet had surgery, 48 (67%) considered their

Table 1. Prevalence of vision loss due to cataract by region in indigenous Australians

Region and state	Number examined	Prevalence of vision loss due to cataract	Odds ratio	Previous cataract surgery	Cataract surgery coverage rate
		(%, 95% CI)	(95% CI)*	(%, 95% CI)	(%)
Region					
Major city	117	2.56 (0.53, 7.49)	1.00	3.42 (0.93, 8.75)	57.14
Inner regional	167	1.80 (0.37, 5.25)	0.61 (0.12, 3.12)	5.39 (2.46, 10.23)	81.82
Outer regional	168	2.38 (0.65, 6.10)	1.06 (0.23–4.92)	2.38 (0.65, 6.10)	50.00
Remote	245	2.04 (0.66, 4.76)	0.64 (0.14–2.84)	4.08 (1.95, 7.51)	66.67
Very remote – coastal	263	3.80 (1.82, 6.99)	0.99 (0.26–3.81)	7.22 (4.34, 11.28)	67.86
Very remote – inland	229	5.24 (2.71, 9.15)	1.23 (0.33–4.54)	7.86 (4.66, 12.42)	62.07
State					
New South Wales	247	1.21 (0.25, 3.55)	1.00	1.62 (0.44, 4.15)	57.14
North Territory	198	4.04 (1.74, 7.96)	2.94 (0.78–11.17)	5.05 (2.42, 9.29)	55.56
Queensland	259	3.86 (1.85, 7.10)	2.12 (0.56–7.99)	8.49 (5.32, 12.86)	68.75
South Australia	129	1.55 (0.19, 5.60)	1.14 (0.18–7.22)	4.65 (1.71, 10.12)	75.00
Tasmania	43	0	N/A	0	–
Victoria	29	0	N/A	6.90 (0.83, 24.91)	100.00
Western Australia	284	4.93 (2.70, 8.27)	2.92 (0.82–10.39)	7.04 (4.30, 10.88)	64.52
Total	1189	3.11 (2.19, 4.29)		5.38 (4.10, 6.67)	65.31

*Multivariable logistic regression including age, gender and education. CI, confidence interval.

vision not sufficiently impaired, 11 (16%) were on a waiting list and 4 (6%) were delaying surgery because of concern about cost.

Visually disabling cataract

Overall, 2.5% (95% CI: 1.6–3.4%) of adults have bilateral vision loss (<6/12) from cataract, 2% (95% CI: 1.3–3.0%) had vision <6/18, and 0.59% (95% CI: 0.24–1.21%) were bilaterally blind from cataract (<6/60). Cataract was responsible for 31.3% (95% CI: 10.7–53.0%) of bilateral blindness (<6/60) and 26.8% (95% CI: 18.5–35.1%) of low vision (<6/12–6/60). The other major causes of blindness were refractive error and optic atrophy, each 14%, and trachoma and diabetes, each 9%.¹² Although the state and regional rates of vision loss due to cataract varied some, the differences were not of statistical significance (Table 1).

The age-specific prevalence of visually significant cataract increased significantly with age ($Z = 7.56$, $P < 0.001$) (Fig. 1), as did the proportion of people who had had cataract surgery ($Z = 9.50$, $P < 0.001$), although the cataract surgery coverage rate did not change by age ($Z = 1.18$, $P = 0.9$).

In this study, there was a strong correlation between cataract and age and education, although correlations were not found between the presence of cataract and gender, smoking, diabetes or sun protection. Those who have a higher education had a decrease in risk for cataract (odds ratio 0.54, 95% CI: 0.31, 0.94) in a logistic regression (Table 2).

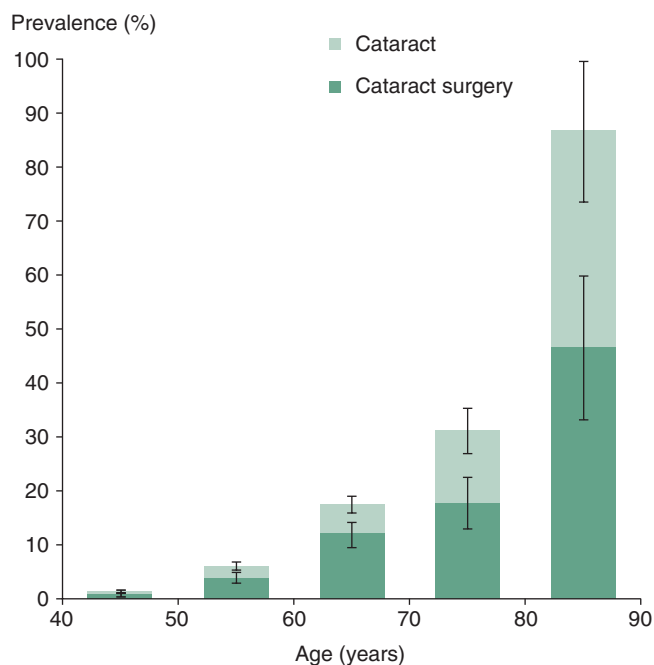


Figure 1. Prevalence of cataract surgery and vision impairment due to cataract by age group (%). Trend test for prevalence of cataract: $Z = 8.53$, $P < 0.001$; Trend test for prevalence of cataract surgery: $Z = 9.50$, $P < 0.001$.

Cataract surgery

In all 64 (6.5%, 95% CI: 5.5–7.5%) people had had cataract surgery. There was no gender or regional difference, although the proportion having had cataract surgery increased rapidly with age ($Z = 9.50$, $P < 0.001$).

Table 2. Factors associated with presence of cataract (univariate and multivariable logistic regression)

Characteristic	Presence of cataract		Self-reported cataract	
	Univariate	Multivariable	Univariate	Multivariable
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age (years)	1.13 (1.11, 1.54)**	1.12 (1.11, 1.16)**	1.10 (1.08, 1.12)**	1.10 (1.07, 1.12)**
Gender (ref: women)				
Men	1.02 (0.67, 1.56)	1.09 (0.66, 1.81)	1.02 (0.72, 1.48)	1.04 (0.68, 1.58)
Education (ref: no school or primary school)				
Post secondary school	0.21 (0.13, 0.33)**	0.54 (0.31, 0.94)*	0.29 (0.20, 0.42)**	0.64 (0.41, 0.98)*
Language (ref: non-English)				
English	0.55 (0.36, 0.84)*	0.69 (0.42, 1.15)	0.74 (0.52, 1.06)	0.82 (0.54, 1.24)
Current smoker (ref: non-smoker)				
Current smoker	0.74 (0.48, 1.13)	1.08 (0.65, 1.78)	0.75 (0.52, 1.08)	1.01 (0.66, 1.55)
Diabetes (ref: no)				
Yes	1.03 (1.00, 1.06)	0.97 (0.59, 1.59)	2.16 (1.15, 3.08)**	1.58 (1.06, 2.37)*
Wearing sun glass (ref: no)				
Yes	0.90 (0.59, 1.38)	1.30 (0.79, 2.17)	0.98 (0.69, 1.41)	1.19 (0.78, 1.80)

* $P < 0.05$; ** $P < 0.001$. CI, confidence interval; OR, odds ratio.

Of those 90 eyes that had cataract surgery, 17 eyes (14 participants) had a presenting visual acuity of less than 6/12 attributed to refractive error (six), posterior capsule opacity (two), diabetic retinopathy (three), glaucoma (two), epiretinal membrane (one), optic atrophy (one), corneal opacity (one) and not recorded (one). Three participants (four eyes) had vision $<6/60$, one person had optic atrophy in the operated eye and the other had been enucleated due to trauma; the second had bilateral diabetic retinopathy and the third who had had bilateral surgery also had interstitial keratitis, although the cause of blindness could not be established.

Projections

These data can be projected to give an estimate 3234 (95% CI: 2287, 4429) indigenous Australians who have vision loss due to cataract and 613 (95% CI: 208, 1248) who are blind from cataract (Table 3).

DISCUSSION

This is the first national report on the prevalence of cataract in Australian and Torres Strait Islander people for 30 years. It confirms the high prevalence of vision-impairing cataract and the need for improved cataract surgical services.

These findings are generally consistent with the self-reported data obtained by the Australian Bureau of Statistics where indigenous Australians are three times more likely than non-indigenous Australians to report vision loss due to cataract, but are four times less likely to have cataract surgery.¹⁵ However, our findings raise some questions about the validity of such self-reported data.

Table 3. Projected requirements for cataract surgery

Region	Estimated number of people requiring cataract surgery <i>n</i> (95% CI)	Cataract operations required per year to maintain national CSR (9500)
Major city	709 (147, 2075)	1162
Inner regional	372 (76, 1085)	883
Outer regional	617 (168, 1581)	1068
Remote	207 (67, 482)	395
Very remote – coastal	391 (187, 719)	416
Very remote – inland	486 (252, 849)	374
State		
New South Wales	410 (85, 1203)	1353
North Territory	483 (208, 951)	510
Queensland	1084 (520, 1994)	1212
South Australia	92 (11, 333)	243
Tasmania	NA	159
Victoria	NA	286
Western Australia	656 (359, 1101)	558
Total	3234 (2287, 4429)	4320

CI, confidence interval; CSR, cataract surgery rate; NA, not applicable.

Knowledge of a personal or family history of cataract and even knowledge about having had cataract surgery was often poor. This reflects the difficulty in communication across cultural and language barriers and further reinforces the important role of Aboriginal Health Workers and other community members in clinical discussions.

The strengths of the present study include its national scope, study design and sampling framework, and the use of a standardized methodology. Its weaknesses include a relatively small sample size,

the limited number of sites and somewhat variable participation rate. The absence of a comprehensive ophthalmic examination limits the ability to establish a definitive cause of vision loss in every case. The small numbers also limit risk factor analysis. The Australian mainstream rates are equivalent to other developed countries¹⁶ but rates of blindness in developing countries are typically much higher and are not dissimilar from the rates found in Australian Aboriginal and Torres Strait Islanders.¹

Blinding unoperated cataract was a much more important cause of blindness in indigenous adults (31%) than in mainstream Australia (14%).³ Age-specific rates suggest that cataract blindness in adult indigenous Australians is approximately 12 times higher than in mainstream.¹² Cataract was also a much more common cause of low vision in indigenous adults (28% vs. 14%) than in mainstream³.

In 1980, the National Trachoma and Eye Health Program reported the causes of blindness in Aboriginal people,⁵ although detailed comparisons with their data are somewhat difficult because of differences in methodology.¹² However, some comparisons can be made and the rate of blindness caused by cataract has not changed much from 40% in 1980 to 37% in this study.

The cataract coverage rate was 65%, which is comparable with the coverage rate of 57% observed in Victoria in the 1990s when most surgery was still without intraocular lenses⁴ but well below the rate of 85% recommended as a target by the World Health Organization.¹⁷

The outcome of surgery with 19% of eyes seeing less than 6/12 is not dissimilar to the 26% reported after cataract surgery in Aboriginal people in the Top End,¹⁸ but less good than the 15% reported in mainstream Victoria.⁴ In these two previous studies, posterior capsule opacity was the leading cause of visual impairment after cataract surgery. However, this study found a high proportion of eyes with postoperative vision loss due to diabetes.

Although the proportion of older indigenous Australians with vision loss due to cataract is unacceptably high, the actual number of people involved and the number of additional operations required is quite small. Projections suggest that currently about 3234 indigenous adults have bilateral vision loss due to cataract and that a total of about 4320 operations per year would bring the cataract surgery rate amongst indigenous Australians to the same level as for the country as a whole (9500 per million people per year). Better use of available facilities and resources, including ophthalmic surgical teams and coordinators, should be able to readily address this unmet need¹⁹ and so eliminate the unnecessary vision loss from cataract in indigenous Australians.

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REFERENCES

1. World Health Organization. *State of the World's Sight: VISION 2020: The Right to Sight: 1999–2005*. Geneva: World Health Organization, 2005.
2. Anderson JR. Our common enemy: blindness. *Trans Ophthalmol Soc Aust* 1948; **6**: 5–43.
3. Taylor HR, Keeffe JE, Vu HTV *et al.* Vision loss in Australia. *Med J Aust* 2005; **182**: 565–8.
4. McCarty CA, Nanjan MB, Taylor HR. Operated and unoperated cataract in Australia. *Clin Experiment Ophthalmol* 2000; **28**: 77–82.
5. Royal Australian College of Ophthalmologists. *The National Trachoma and Eye Health Program of the Royal Australian College of Ophthalmologists*. Sydney: Royal Australian College of Ophthalmologists, 1980.
6. Taylor HR. Prevalence and causes of blindness in Australian Aborigines. *Med J Aust* 1980; **1**: 71–6.
7. Fox SS, Arnold A-L, Keeffe JE, Taylor HR. Sampling and recruitment methodology for a National Eye Health Survey of Indigenous Australians. *Aust N Z J Public Health* 2010; (in press).
8. Australian Bureau of Statistics (ABS). 1216.0 – Australian Standard Geographical Classification (ASGC) – Electronic Publication. 2005. Accessed January 2010. Available from: <http://www.abs.gov.au/AUSSTATS/abs@.nsf/lookup/0D204FD3DCD90564CA256F19001303A2?opendocument>
9. Australian Bureau of Statistics (ABS). 2006 Census. 2006 Accessed January 2009. Available from: <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/3238.0.55.001Main+Features1Jun%202006?OpenDocument>
10. Taylor HR, Fox SS. Ethical hurdles in Indigenous research. *Aust N Z J Public Health* 2008; **32**: 489–90.

11. Studdert DM, Vu TM, Fox SS, Anderson IP, Keeffe JE, Taylor HR. Ethics review of multisite studies: the difficult case of community-based Indigenous health research. *Med J Aust* 2010; **192**: 275–80.
12. Taylor HR, Xie J, Fox SS, Dunn RA, Arnold A-L, Keeffe JE. The prevalence and causes of vision loss in Indigenous Australians: the National Indigenous Eye Health Survey. *Med J Aust* 2010; **192**: 312–18.
13. Keeffe JE, Lovie-Kitchen JE, Maclean H, Taylor HR. A simplified screening test for identifying people with low vision in developing countries. *Bull World Health Organ* 1996; **75**: 525–32.
14. Ferraro JG, Pollard T, Muller A, Lamoureux EL, Taylor HR. Detecting cataract causing visual impairment using a nonmydriatic fundus camera. *Am J Ophthalmol* 2005; **139**: 725–6.
15. Trewin D, Madden R. *The Health and Welfare of Australia's Aboriginal and Torres Strait Islander Peoples* 2005. Canberra: Australian Institute of Health and Welfare 2005. Report No.: ABS Catalogue No. 4704.0, AIHW Catalogue No. IHW14, ISSN 1441-2004.
16. Congdon N, Vingerling JR, Klein BEK *et al.* Prevalence of cataract and pseudophakia/aphakia among adults in the United States. *Arch Ophthalmol* 2004; **122**: 487–94.
17. World Health Organization. *Vision 2020 The Right to Sight Global Initiative for the Elimination of Avoidable Blindness Action Plan 2006–2011*. Geneva: World Health Organization, 2007.
18. Hewitt A, Verma N, Gruen R. Visual outcomes for remote Australian Aboriginal people after cataract surgery. *Clin Experiment Ophthalmol* 2001; **29**: 68–74.
19. Wearne SM. Remote Indigenous Australians with cataracts: they are blind and still can't see. *Med J Aust* 2007; **187**: 353–6.