

# Visual impairment among Aboriginal and Torres Strait Islander patients attending an Australian Indigenous primary health service: a cross-sectional study

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**Abstract.** This cross-sectional study aimed to identify the period prevalence of visual impairment (VI) and blindness among Aboriginal and Torres Strait Islander people attending an Indigenous urban primary healthcare service, eye care practitioner referrals for those with VI and any opportunities to improve care delivery. Visual acuity (VA) examinations, using a Snellen chart, are performed as part of routine annual health assessments offered to children and adults. This study included patients aged  $\geq 5$  years ( $n = 1442$ ) who had a health assessment conducted between 1 January 2015 and 31 December 2016 and provided consent for the use of their health assessment information for research. Of patients with available data, 2.4% (33/1374) experienced VI, defined as presenting VA worse than 6/12 to 6/60 in the better-seeing eye. VI was more common in those aged  $\geq 60$  years (14/136; 10.3%) and was significantly associated with increasing age ( $P < 0.001$ ). No patients experienced blindness, defined as presenting VA worse than 6/60 in the better-seeing eye. All patients with VI were aged  $\geq 16$  years. Nine (27%) of the 33 patients with VI in the better-seeing eye were referred to an optometrist or an ophthalmologist. The low period prevalence of VI and no blindness in this study are positive findings. The findings also indicate that routine VA testing of older adults, especially those aged  $\geq 60$  years, should be conducted to avoid missing those not having an annual health assessment.

**Additional keywords:** health promotion, Indigenous health services, primary health care.

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## Introduction

Good vision has a profound effect on a person's quality of life and facilitates access to education, employment and maintaining independence in performing activities of daily living (Abouzeid *et al.* 2015). Studies investigating vision loss among Aboriginal and Torres Strait Islander people (hereafter respectfully referred to as Indigenous) found that most causes were preventable or treatable (Taylor 1980; Landers *et al.* 2010; Taylor *et al.* 2010; Foreman *et al.* 2016). The 2016 National Eye Health Survey (NEHS) of non-Indigenous Australians aged  $\geq 50$  years and Indigenous adults aged  $\geq 40$  years reported a threefold higher prevalence of age-adjusted vision loss and blindness in Indigenous people compared with non-Indigenous Australians (13.6% vs 4.6% and 0.36% vs 0.12% respectively) (Foreman

*et al.* 2016, 2017). The main causes of treatable or avoidable visual impairment (VI) included uncorrected refractive error (60.8%), cataract (20.1%) and diabetic retinopathy (5.2%). Refractive error can be prevented with early detection and corrected with relatively inexpensive prescription spectacles (Vos and Taylor 2013; Keel *et al.* 2017). However, the NEHS reported a refractive error treatment rate and cataract coverage of 83.2% and 61.4% respectively among Indigenous adults, compared with 93.6% and 87.6% respectively among non-Indigenous Australians (Foreman *et al.* 2016). This inequity of access to treatment for refractive error contributes to the higher prevalence of VI and blindness experienced by Indigenous peoples (Foreman *et al.* 2016).

Initiatives to reduce the rate of VI for Indigenous peoples have been implemented in Australia with positive outcomes, including a tripling in the number and occasions of services provided to Indigenous people under the Visiting Optometrist Scheme between 2009–10 and 2016–17 (AIHW 2018). Primary healthcare services play an important role in the early identification and treatment of VI, including referral to specialist services (Taylor *et al.* 2012; Abouzeid *et al.* 2015; Burnett *et al.* 2016; Indigenous Eye Health 2017; AIHW 2018). No published study has reported on the prevalence of VI among Indigenous people in the primary healthcare setting. A study of 124 Indigenous primary healthcare centres reported wide variations in the percentage of people recorded as having vision assessments according to the recommended guidelines (Burnett *et al.* 2016).

The aim of this study was to identify the period prevalence of VI among Indigenous people attending the Southern Queensland Centre of Excellence in Aboriginal and Torres Strait Islander Primary Health Care (henceforth CoE), specialist referral patterns for those with VI and opportunities to enhance the care of Indigenous patients with VI and blindness.

## Methods

### *Study design, sample and setting*

The present cross-sectional study included Indigenous patients aged  $\geq 5$  years who had at least one health assessment conducted between 1 January 2015 and 31 December 2016 at the CoE and had consented for their or their child's health assessment information to be used for research. If any patient had more than one health assessment in the study period, the most recent health assessment was used. The CoE is located at Inala, a suburb in south-western Brisbane, Australia, and provides integrated primary and specialist health services, including a specialist ophthalmology service offering diabetes-related and other vision services (Hayman *et al.* 2014).

### *Health assessment and visual acuity*

Health assessments were initiated to address the health status gap between Indigenous and non-Indigenous peoples in Australia (Mayers and Couzos 2004) and were funded through the Australian Government Medicare Benefit Scheme (Australian Government Department of Health 2014). At the CoE, a registered nurse initiates the computerised health assessment and the assessment is then completed by a general practitioner (GP) (Spurling *et al.* 2009, 2013). Completed health assessments are stored in a separate software program, with a copy added to the patient's clinical notes.

Visual acuity (VA) is tested, usually by the registered nurse, as part of the health assessment for patients aged  $\geq 5$  years. The nurse uses a 3-m Snellen chart, which has a 6-m equivalent, to score VA. The patient reads rows of letters in different sized prints (large to small) (AIHW 2011). Children who have difficulty reading use a shape (square, circle, rectangle, star) placed next to each row of the Snellen chart. The VA score corresponding to the lowest line that the patient correctly identified all, or all except one letter, was recorded as the denominator. A score of '0' was recorded to indicate the presence of blindness (when the VA was worse than 6/60), with 6/60 being the lowest VA score on the Snellen chart.

Patients were asked whether they routinely wore prescription spectacles. All patients who had brought their prescription spectacles wore them during the VA test. The variable 'Glasses used' had response options 'Yes', 'No' and 'Missing' to indicate whether spectacles were used during the assessment. Measurement of the right eye VA was conducted with the left eye occluded, and vice versa for left eye measurement (unilateral), followed by VA testing with both eyes open (binocular). Participants' self-reported descriptions of vision problems were recorded in the accompanying comment section. If VA was subnormal, a pinhole test of VA was performed by the nurse or GP to distinguish reduced vision due to refractive error from other causes of reduced vision (Naidoo and Govender 2002).

### *Definitions of normal vision and VI*

The NEHS definitions for normal vision and VI were used in this study (Taylor *et al.* 2010; Foreman *et al.* 2016). Normal vision was defined as presenting VA (PVA) scores of 6/12 or better ( $\geq 6/12$ ) in the better-seeing eye. In this study, the better-seeing eye was derived from comparing the PVA scores for the right and left eyes.

VI was defined as PVA scores worse than 6/12 to 6/60 ( $< 6/12$  to 6/60) in the better-seeing eye (Foreman *et al.* 2016). Blindness was defined as PVA scores worse than 6/60 ( $< 6/60$ ) in the better-seeing eye (Foreman *et al.* 2016).

### *Statistical analysis*

#### *Variables*

Data for the following variables were extracted from the completed health assessment: age, sex, ethnicity, prescription spectacles or pinhole used for testing, VA scores, any visual problems identified and any referrals to ophthalmology or optometry services.

#### *Data analysis*

Computerised health assessment data were downloaded into Excel files (Microsoft Corporation, Redmond, WA, USA), deidentified, with only the most recent assessment data retained if a patient had more than one assessment conducted during the study period, and imported into the statistical software program STATA version 14.1 (StataCorp, College Station, TX, USA) for analysis. The reporting of this cross-sectional study using routinely collected health data was guided by the REporting of studies Conducted using Observational Routinely collected Data (RECORD) statement (Benchimol *et al.* 2015).

Descriptive statistics were used to describe demographic characteristics, period prevalence of VI and blindness (stratified by age and sex) and referrals to an optometrist or ophthalmologist. The percentage of patients with VI who were wearing prescription spectacles (indicating undercorrected refractive error) was determined. The Shapiro–Wilk test for normality was conducted on all variables and, where appropriate, Pearson's Chi-squared test or Fisher's exact test was used to compare groups (age and sex).  $P < 0.05$  was considered significant. Missing data resulted in variations in denominators.

**Table 1. Sociodemographic characteristics of patients included in the study ( $n = 1442$ )**Unless indicated otherwise, data are presented as  $n$  (%)

Age (years)	
Children 5–15 years ( $n = 316$ )	
Mean $\pm$ s.d.	10.2 $\pm$ 3.1
Median	10
Minimum–maximum	5–15
Adults $\geq 16$ years ( $n = 1126$ )	
Mean $\pm$ s.d.	39.5 $\pm$ 16.0
Median	39
Minimum–maximum	16–85
All patients	
Mean $\pm$ s.d.	33 $\pm$ 19
Median	31
Minimum–maximum	5–85
Age group (years)	
5–15	316 (21.9)
16–29	382 (26.5)
30–44	315 (21.8)
45–59	283 (19.6)
$\geq 60$	146 (10.1)
Sex	
Male	768 (53.3)
Female	674 (46.7)
Ethnicity	
Aboriginal	1313 (91.1)
Torres Strait Islander	54 (3.7)
Aboriginal and Torres Strait Islander	75 (5.2)

### Ethical considerations

The project received community approval from the Inala Community Jury for Aboriginal and Torres Strait Islander Health Research (Bond *et al.* 2016) and the Metro South Human Research Ethics Committee considered the project exempt from ethical review (HREC/17/QPAH/232).

## Results

### Demographic characteristics

In the 2-year study period, consent for use of the information for research was not recorded for 559 (23.8%) of the 2350 completed health assessments, and these were excluded from the study. An additional 349 health assessments were excluded if a person had multiple assessments during the study period. The final sample consisted of 1442 patients (aged 5–85 years, mean 33 years) with same number of health assessments for analysis.

Table 1 presents the sociodemographic characteristics of patients in the study. There was no significant difference in the percentage of male and female patients (53.3% and 46.7% respectively;  $P = 0.66$ ). One-fifth of participants were children aged between 5 and 15 years. Most patients identified as being of Aboriginal ethnicity (Table 1).

### Visual impairment

Snellen letter PVA scores in the better-seeing eye ranged between 6/4 and 6/60 for 1374 patients with available data. A small proportion of these patients ( $n = 33$ ; 2.4%) aged  $\geq 16$  years were identified as having VI, 72.7% (24/33) of whom were aged

**Table 2. Patients with visual impairment (VI) in the better-seeing eye ( $n = 33$ ), stratified by age and sex, of the 1374 patients with available data**

CI, confidence interval			
No. patients with data <sup>A</sup>		VI in better-seeing eye	
		No. patients	% (95% CI)
Sex			
Female	645	15	2.3 (1.3–3.8)
Male	729	18	2.5 (1.5–3.9)
Total	1374	33	2.4
Age group (years)			
5–15	293	0	0
16–29	374	4	1.1 (0.2–2.7)
30–44	301	5	1.7 (0.5–3.8)
45–59	270	10	3.7 (1.8–6.7)
$\geq 60$	136	14	10.3 (5.7–16.7)
Total	1374	33	2.4

<sup>A</sup>Data regarding the presence of VI was missing for 68 of 1442 patients.

**Table 3. Prevalence of visual impairment (VI), defined as visual acuity (VA) scores  $< 6/12$  in the better-seeing eye, among Aboriginal and/or Torres Strait Islander patients who had VA tested with and without spectacles**

Data are presented as $n$ (%)		
	No VI	VI present
Spectacles not worn during VA testing	1134 (88.7)	28 (84.8)
Spectacles worn during VA testing <sup>A</sup>	144 (11.3)	5 (15.2)
Total	1278 (100)	33 (100)

<sup>A</sup>People who were tested while wearing their current spectacles.

$\geq 45$  years, with VI most frequently detected in those aged  $\geq 60$  years (14/33 (42.4%); Table 2). VI was not detected in any patients aged  $\leq 15$  years (Table 2). There was a trend towards an increase in VI with increasing age ( $P < 0.001$ ), and no significant difference in VI according to sex ( $P = 1.0$ ; Table 2).

Of the five patients who had pinhole VA testing, none had VI in the better-seeing eye.

Most patients with VI (28/33; 84.8%) were not wearing spectacles at the time of VA testing. Of those wearing spectacles ( $n = 149$ ), five (3.4%) had VI, three of whom were not referred to an eye care practitioner (Table 3).

### Period prevalence of blindness

No patient experienced blindness in this study. However, five patients had reduced PVA ( $< 6/60$ ), either in the right (2/1377; 0.2%) or left (3/1376; 0.2%) eye, with vision in the better-seeing eye ranging between 6/6 and 6/18. Of these five patients, three were male and two female, with ages ranging between 50 and 85 years.

### Referral to an eye care practitioner

Nine (27.3%) of 33 patients with VI were referred to either an optometrist ( $n = 8$ ) or an ophthalmologist ( $n = 1$ ). An additional 50 of 1341 (3.7%) patients who had no VI were referred

to either an optometrist (38/50; 76%) or ophthalmologist (12/50; 24%). Of these patients, 24% ( $n = 12/50$ ) had PVA scores of 6/12 or better in the better-seeing eye, but worse than 6/12 in the other eye.

## Discussion

This study found that an encouragingly small proportion of people aged  $\geq 16$  years experienced VI (2.4%) and no participant experienced blindness. Furthermore, no child (age  $\leq 15$  years) experienced VI or blindness. Consistent with other studies, the period prevalence of VI increased with age and was not significantly associated with sex (Landers *et al.* 2010; Foreman *et al.* 2016).

The low rates of VI in the better-seeing eye among Indigenous children and adults found in this study and the lack of any bilateral blindness are different to the higher rates reported from other studies of VI among Indigenous people in Australia. The 2008 and 2016 national surveys of Indigenous adults aged  $\geq 40$  years reported rates ranging between 9.4% and 13.6% for VI and between 1.9% and 0.36% for bilateral blindness (Taylor *et al.* 2010; Foreman *et al.* 2016). Some methodological differences (such as settings, the VA measurement technique and samples used) may have contributed to the differences between the national surveys and the present study. Both national surveys were point prevalence studies, conducted at multiple sites in a variety of geographic regions, and only included adults aged  $\geq 40$  years. The present study was a period prevalence study, conducted over 2 years at one urban primary healthcare setting and included children and adults of all ages (mean age 33 years). Analysis of data for patients aged  $\geq 40$  years in the present study found a VI rate 8.7% lower than that in the 2016 survey, and we found no instances of blindness. A study of Indigenous peoples aged  $\geq 20$  years residing in remote communities of central Australia reported higher prevalence rates for VI (19.4%) and bilateral blindness (2.8%; Landers *et al.* 2010).

Similar methodological differences could explain the finding of no VI in children in the present study compared with VI rates reported in other studies. The 2008 National Indigenous Eye Health Survey reported that 1.5% and 0.2% of children experienced VI and blindness respectively (Taylor *et al.* 2010). Another study of children reported a low prevalence of VI (0.6%) among Indigenous children aged between 5 and 13 years attending nine primary schools located in metropolitan or rural areas in Queensland (Hopkins *et al.* 2016).

### *Opportunities to improve care delivery*

Our service has implemented the recommended initiatives listed in the Roadmap to Closing the Gap for Vision (Taylor *et al.* 2015) and could have contributed to our positive and encouraging findings of a low rate of VI and no blindness. These initiatives include early identification of VI by including VA examinations in the annual health assessments for all patients, retinal photography for patients with diabetes and a visiting ophthalmologist providing easily accessible eye health care in a culturally safe environment.

Some opportunities to improve care delivery in this service were identified from this study. VI was experienced by a higher percentage of older people in the study, highlighting the need

for standardised VA testing of all older patients attending the primary healthcare service to avoid missing the screening of patients who do not have an annual health assessment. The study also found that some of the patients wearing spectacles at the time of VA testing had VI, indicating an undercorrected refractive error, or that the cause of vision loss was pathological and cannot be corrected with spectacles. Three of the five patients not referred to an eye care practitioner may have benefited from an ophthalmological intervention to prevent further vision loss.

Pinhole testing is helpful in identifying patients who would benefit most from prescription spectacles or optometry referral. This study identified that pinhole acuity was not recorded in most cases and that there should be a greater use of pinhole VA testing. Whereas this may have affected the rate of referrals in this study, it would not have affected the rate of VI, which was based on the PVA. Some nurses were not confident in pinhole testing, with GPs commonly having to conduct it at this service. A review of existing protocols for VA assessment and ongoing staff training on VA testing, referral criteria and the need for pinhole testing in cases of reduced VA is required to enhance the care of patients attending this primary healthcare service. This will ensure that nurses are more efficient at conducting VA testing, including pinhole testing.

A small proportion of patients with no VI in the better-seeing eye were referred to an eye care practitioner for review due to reduced VA in the worse eye. Although this is good practice (because every unexplained vision loss needs further evaluation), the lack of referral of some people with VI in the better-seeing eye (who could have benefited from further review) in this study suggests the need for a clearer guideline regarding the referral of patients with VI in the service.

### *Study strengths and limitations*

This study provides evidence on the prevalence of VI and blindness and the delivery of eye care services in an urban Indigenous primary care setting. Distance VA may not be the most appropriate clinical measure to represent functional vision, with suggestion that contrast sensitivity may be more highly associated with visual functioning (Holton *et al.* 2011). VA testing during health assessment is used to screen patients for the presence of any VI. Because best-corrected VA is the most widely used and standardised measure in daily clinical routine, the use of this measure enhances the applicability of our findings.

The study has some limitations. The findings are only applicable to patients who attended the primary healthcare service in the 2-year study period. In addition, data for Indigenous patients with VI who may have seen an eye specialist at another location were not captured in this study. As a single-site study, the findings may not be generalisable to other Indigenous patients attending Australian primary healthcare services.

Limitations of using routinely collected data include missing data and the brief, clinically appropriate visual assessment for primary care rather than the extensive VA measurement techniques used in the other referenced studies to compare VI and blindness rates. This study highlights the need for better recording of information during VA testing. Missing information as to



whether patients normally wore prescription spectacles and/or did not wear them on the day of VA testing made it difficult to identify the number of patients requiring vision correction and referral for specialist assessment and intervention. The reasons for referring people with normal vision to an eye care practitioner were not documented in the health assessment form, making it difficult to determine whether this was an area for quality improvement. This information may have been detailed on the referral letter and in patients' medical notes. Future research in this area could make use of patients' medical records, including details of specialist referrals and outcomes, which would provide more information than that available in the health assessment snapshot of information at one point in time.

## Conclusion

The low prevalence of VI and no blindness among Indigenous people having health assessments at an urban Indigenous primary healthcare service is positive and encouraging. Opportunities for improving care delivery were identified. The finding that VI increased with age emphasises the important role of primary health care in detecting VI and maintaining good vision among older people. The positive findings in this study support the role of regular VA assessment as part of health assessments in the setting of continuous, comprehensive primary health care that integrates specialist care as needed.

## Conflicts of interest

All authors were employed at the health service where the study was conducted.

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