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Prevalence of visually significant cataract and cataract surgical coverage in Indigenous and non-Indigenous Australians: a systematic review and meta-analysis

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ABSTRACT

Aims Compare the prevalence of age-related cataract and the cataract surgical coverage rate between Indigenous and non-Indigenous Australians and explore differences in these estimates across location and time.

Methods The Joanna Briggs Institute guidance for systematic reviews of prevalence studies was followed. A systematic search of Medline, Embase, Web of Science and grey literature from database inception to June 2022 was performed. All studies reporting cataract prevalence in Australian populations were included. Pooled prevalence estimates were derived using meta-analyses with a random-effects model. Nine studies enrolling 36 302 participants were included. Most studies only reported the prevalence of cataract causing vision loss (visual acuity<6/12) or blindness (visual acuity<6/60), restricting our meta-analysis to these definitions.

Results Cataract causing unilateral vision loss was common in both Indigenous and non-Indigenous adults (3.5% and 3.6%, p=0.891). Indigenous adults had a higher prevalence of bilateral vision loss (3.6% vs 1.1%, p=0.011) and bilateral blindness (0.385% vs 0.001%, p=0.002) than non-Indigenous adults. Cataract surgical coverage was lower in Indigenous (68.0%; 95% CI, 55.9 to 79.0) than non-Indigenous (88.4%; 95% CI, 79.9 to 94.8) adults (p=0.004). No differences in bilateral vision loss, blindness or surgical coverage were found between rural and urban subgroups or between studies conducted before and after the year 2000.

Conclusions Cataract causes vision loss in a substantial number of adults living in urban and rural Australia. Policies to improve diagnosis and surgery rates should be prioritised, particularly for Indigenous Australians who experience a disproportionate burden of advanced cataract and reduced access to surgery.

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WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Indigenous Australians suffer disproportionately from vision loss. However, direct comparisons of the prevalence and treatment coverage of cataract between Indigenous and non-Indigenous Australians are lacking.

WHAT THIS STUDY ADDS

⇒ Indigenous Australians have a higher pooled prevalence of bilateral vision loss (3.6% vs 1.1%, p=0.011) and bilateral blindness (0.385% vs 0.001%, p=0.002) from cataract coupled with lower cataract surgery coverage (68.0% vs 88.4%, p=0.004).

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Our study highlights the need to develop and support strategies which improve Indigenous access to diagnostic and surgical services for visually significant cataract, such as those outline in Vision 2020's Strong Eyes, Strong Communities plan. Future research should also overcome the identified gaps in our epidemiological understanding of cataract in Australia.

INTRODUCTION

In 2020, the Vision Loss Expert Group reported that age-related cataract was the leading cause of blindness and second leading cause of visual impairment worldwide.[1 2] Their meta-analysis showed that in contrast to developing regions, the prevalence of visually significant cataract in developed nations, such as Australia, was low. However, this only included five Australian studies which all collected data before the year 2000 and had low numbers of Indigenous people. Since 2000, several studies have explored cataract rates in Indigenous and non-Indigenous Australians, including the 2015–2016 National Eye Health Survey (NEHS). The NEHS reported a prevalence of visually significant cataract in either eye among non-Indigenous Australians of 2.7%, low when compared with other developed nations.[3] This was attributed to highly accessible surgery for this population.[3] In contrast, Indigenous Australians underwent

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surgery less frequently and were more likely to have a visually significant cataract, with a prevalence of 4.3%. Other studies have found an even greater prevalence of cataract causing bilateral vision loss in Indigenous Australians, with rates of up to 5.9% being comparable to developing nations in Asia and Africa.[2 4] Despite these disparities, the NEHS is the only recent study which has performed a statistical comparison of cataract prevalence between Indigenous and non-Indigenous Australians.

Disparities in the prevalence of visually significant cataract may arise from reduced access to surgery, which can be assessed through cataract surgical coverage (CSC) rates. This measures the number of people in a population who have had cataract surgery as a proportion of all people who have had or still require surgery. Differences in CSC between Indigenous and non-Indigenous Australians have been underexplored.[5]

Furthermore, no analysis of the temporal trends of cataract prevalence or CSC in Australia has been performed. Such trends could evaluate Australia's progress towards its commitment to eliminating avoidable vision loss.[6]

To address these gaps, we conducted the first systematic review and meta-analysis of the pooled prevalence of age-related cataract and CSC in Indigenous and non-Indigenous Australians. Differences in these estimates across location and time were evaluated. This data may guide public health strategies to reduce the burden of cataract, particularly in populations with reduced access to surgery.

METHODS

This review followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines and Joanna Briggs Institute (JBI) guidance for systematic reviews of prevalence studies.[7 8] Two reviewers (MN and SB) independently screened studies for eligibility, extracted data and assessed risk of bias. Discrepancies were resolved by consensus or arbitration with a third reviewer (HR). There was one deviation from our preregistered protocol, to allow 'examination with a direct or head-mounted ophthalmoscope' as a valid method for diagnosis of cataracts. This was made to include more data in rural Australia, where slit lamp examination is not always possible. It is considered minor with minimal risk of introducing bias.

Search strategy

The PRISMA-S checklist was used to improve transparency of the search strategy.[8] MEDLINE (Ovid), Embase and Web of Science were searched from inception to June 2022 using the strategy in online supplemental appendix A, with no limits or filters. Records were imported into and deduplicated using EndNote V.20. Multiple grey literature sources were searched (online supplemental appendix A). Reference lists of reviews and included reports were screened for additional reports.

Eligibility criteria

We included studies reporting the prevalence of age-related cataract diagnosed through anterior segment photography, slit-lamp examination or direct or head-mounted ophthalmoscopy. Studies were excluded if they only reported on congenital or other non-age-related cataract, or if diagnosis was based on medical records or self-report. Studies of Indigenous and non-Indigenous Australian populations of all ages were included. As per the Indigenous Status Standard used by the Australian Bureau of Statistics,[9] participants were considered Indigenous based on self-identification as Aboriginal and/or Torres Strait Islander, and non-Indigenous if they did not identify as belonging to these groups. Studies of non-Indigenous ethnic subgroups or non-screening populations were excluded. Corresponding authors were contacted for clarification of diagnostic methods and/or missing data, when necessary.

Data collection and risk of bias assessment

The following data were collected into standardised, prepiloted forms: study period, location, design, participant characteristics, risk factors for cataract, diagnostic methods and criteria, and outcomes of interest. The 2011 Australian Statistical Geographical Classification-Remoteness Area (ASGC-RA) was used to classify location as either urban ('Major cities of Australia') or rural (other ASGC-RA classifications).[10] Primary and secondary outcomes were the prevalence of age-related cataract and CSC, respectively. As CSC was not consistently reported, it was calculated, where possible, based on WHO's definition[11]:

$$CSC = 100 \times \frac{n1}{n1+n2}$$

Where n1 is the number of participants who have had cataract surgery in one or both eyes, and n2 is the number with bilateral vision loss (visual acuity (VA)<6/12), after best correction, caused by cataract. Risk of bias assessments and quality scores were obtained using the JBI Critical Appraisal Checklist, described previously (online supplemental appendix B).[7 12] Overall quality of evidence was assessed using the GRADE (Grading of Recommendations Assessment, Development and Evaluation) approach modified for observational studies.[12]

Data synthesis and analysis

Pooled estimates and 95% CIs were calculated for cataract prevalence and CSC in Indigenous and non-Indigenous subgroups. Further subgroup analyses by location and time (pre-2000 and post-2000) were conducted when there were at least two studies per subgroup. The year 2000 was selected to achieve a balanced distribution of studies in each subgroup. Prespecified sensitivity analysis was done by excluding low-quality studies (quality score≤5).

Meta-analyses were performed using Freeman-Tukey double arcsine transformation with a random-effects model to allow for between-study variation.[7] Between-study heterogeneity was assessed by the I^2 statistic and characterised as low (≤50%) or high (>50%). Publication bias was unassessed given known limitations of

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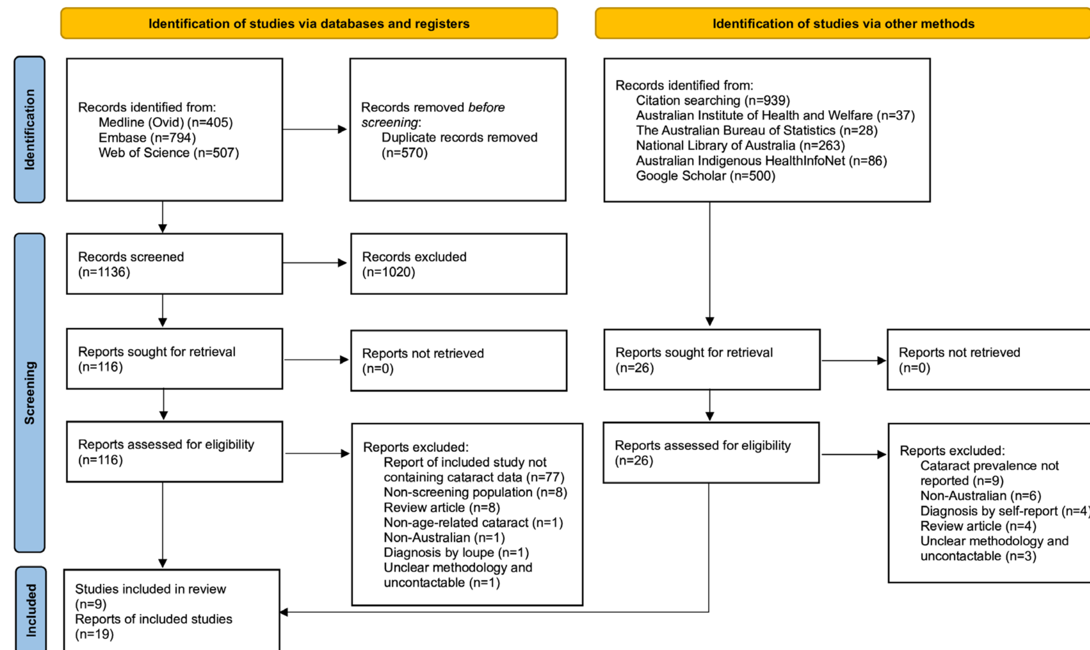

Figure 1 Preferred Reporting Items for Systematic reviews and Meta-Analyses flow diagram of study selection.

these assessments on proportional data.[13] Analyses were performed in Stata (STATA V.16, Stata Corp, TX, USA).

RESULTS

Study characteristics

Of the 1136 unique database records identified, we included 19 reports from nine studies reporting prevalence of age-related cataract in 36 302 (16 070 Indigenous and 20 232 non-Indigenous) adults (figure 1, online supplemental appendix C).[3 4 14–20] There were two studies of Indigenous participants, three containing both Indigenous and non-Indigenous cohorts and four of the general population that did not specify Indigeneity (table 1). The latter four were classified as non-Indigenous since less than 1.5% of their sample were Indigenous based on census data.[15–18] Study periods ranged from 1976 to 2016, with five conducted prior to 2000. There were three rural studies, three urban and three conducted in both rural and urban locations. Mean ages ranged from 42 to 55 years and 59–67 years for Indigenous and non-Indigenous cohorts, respectively (online supplemental table S1). Diabetes was self-reported in 36%–55% of Indigenous participants and 6%–14% of non-Indigenous participants (online supplemental table S1).

Diagnosis and classifications of cataract

Cataracts were diagnosed by multiple independent graders of lens photographs in five studies[3 16–18 20] and from clinical examination in four studies (three via slit-lamp[4 14 15] and one via direct and indirect ophthalmoscopy).[19] The two studies which did not dilate pupils utilised anterior segment photography, which has comparable accuracy to dilated slit-lamp examination.[3 20]

Most studies reported the prevalence of visually significant cataract as a cause of (1) unilateral vision loss, (2) unilateral blindness, (3) bilateral vision loss or (4) bilateral blindness. As these were the most consistently reported measures of cataract, they were used for the meta-analysis. All studies conducted complete examinations of the eye, including the retina, to identify other pathologies which may contribute to vision loss. Seven studies explicitly stated that when multiple pathologies were present, the condition with the most clinically significant influence on vision was selected as the primary cause of vision loss.[3 4 14 16–19] The remaining two studies did not explicitly state how they ascribed the primary cause in the presence of multiple pathologies.[15 20] While seven studies used the same definitions of vision loss (VA<6/12) and blindness (VA<6/60), the National Trachoma and Eye Health Program (NTEHP) defined blindness as a VA≤6/60 and Newland *et al* defined vision loss and blindness as a VA<6/18 and <3/60, respectively.[14 15] Four studies defined cataract as a lens opacity regardless of VA,[4 16–18] and reported the prevalence of cortical, nuclear and posterior subcapsular cataract (PSC) subtypes using different grading systems which prevented a meta-analysis.

Cataract prevalence and cataract surgical coverage

Pooled estimates of visually significant cataract prevalence and CSC are shown in table 2. Bilateral vision loss from cataract was more common in the Indigenous (3.6%; 95% CI, 1.8 to 6.1) than non-Indigenous (1.1%; 95% CI, 0.6 to 1.8) subgroup (p=0.011) (figure 2A). Bilateral blindness from cataract was more common in the Indigenous (0.385%; 95% CI, 0.121 to 0.782) than non-Indigenous (0.001%; 95% CI, 0.000 to 0.047) subgroup (p=0.002). Pooled estimates of bilateral blindness from cataract excluded the 1976–1979 NTEHP, which reported

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Table 1 Characteristics of included studies reporting the prevalence of age-related cataract in Indigenous and non-Indigenous Australians

Author (year), study name	Study period	Location	Sampling method	Sample size	Indigenous (%)	Definition of cataract	Outcomes reported	Results
RACO (1980),[14] National Trachoma and Eye Health Program (NTEHP)	1976–1979	National (rural)	Consecutive sampling of communities	I: 10 434* NI: 3004	78	Lens opacity with VA<6/6	Bilateral blindness	3.4% (I) and 0.5% (NI)
Newland *et al* (1996)[15]	1989–1990	SA (40% urban, 60% rural)†	Random cluster sampling	NI: 2115	<1.5	Lens opacity with VL	Unilateral blindness Bilateral VL Bilateral blindness CSC	0.6% 0.9% 0.2% 86.5%
Mitchell *et al* (1996),[16] Blue Mountains Eye Study (BMES) I	1992–1994	Sydney, NSW (urban)	Community-based census	NI: 3646	<1.5	Lens opacity (Wisconsin cataract grading system)	Unilateral VL Unilateral blindness Bilateral VL Bilateral blindness CSC Cataract subtypes	5.2% 0.7% 1.8% 0.05% 76.7%
McCarty *et al* (1999),[17] Melbourne Visual Impairment Project (MVIP)	1992–1996	VIC (69% urban, 31% rural)	Random cluster sampling	NI: 4744	<1.5	Lens opacity (Wilmer cataract grading system)	Bilateral VL Bilateral blindness CSC Cataract subtypes	0.3% 0.0% 92.8%
Tan *et al* (2006),[18] Blue Mountains Eye Study (BMES) II	1997–2000	Sydney, NSW (urban)	Community-based census	NI: 3508	<1.5	Lens opacity (Wisconsin cataract grading system)	Unilateral VL Unilateral blindness Bilateral VL Bilateral blindness CSC Cataract subtypes	4.0% 0.4% 1.3% 0.03% 86.0%
Clark *et al* (2010),[19] Goldfields Eye Health Survey	1995–2007	Eastern Goldfields, WA (rural)	Clinic-based consecutive sampling	I: 920	100	Lens opacity with VL	Unilateral blindness Bilateral blindness	1.1% 0.2%
Landers *et al* (2010),[4] Central Australian Ocular Health Study (CAOHS)	2005–2008	Central Australia, NT (rural)	Clinic-based consecutive sampling	I: 1809	100	Lens opacity (Modified Lens Opacities Classification System III)	Unilateral VL Unilateral blindness Bilateral VL Bilateral blindness CSC Cataract subtypes	 6.6% 3.7% 5.9% 0.8% 61.2%

Continued

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Table 1 Continued

Author (year), study name	Study period	Location	Sampling method	Sample size	Indigenous (%)	Definition of cataract	Outcomes reported	Results
Taylor *et al* (2010),[20] National Indigenous Eye Health Survey (NIEHS)	2008	National (9% urban, 91% rural)‡	Random cluster sampling	I: 1189 NI: 136	90	Lens opacity with VL	Unilateral VL Unilateral blindness Bilateral VL Bilateral blindness CSC	2.9% (I) and 3.7% (NI) 0.6% (I) and 0.0% (NI) 3.1% (I) and 4.4% (NI) 0.6% (I) and 0.0% (NI) 63.4% (I)
Keel *et al* (2019),[3] National Eye Health Survey (NEHS)	2015–2016	National (43% urban, 57% rural)§	Random cluster sampling	I: 1718 NI: 3079	36	Lens opacity with VL	Unilateral VL Unilateral blindness Bilateral VL Bilateral blindness CSC	1.6% (I) and 2.2% (NI) 0.3% (I) and 0.2% (NI) 2.3% (I) and 0.9% (NI) 0.1% (I) and 0.0% (NI) 78.5% (I) and 95.8% (NI)

*RACO examined participants 0–60+ years old. To best reflect age-related cataract, only data from participants ≥40 years were included.
†Urban and rural data not reported separately.
‡Proportions presented for Indigenous sample. Non-Indigenous sample were all from rural locations.
§Proportions presented for Indigenous sample. Non-Indigenous sample proportions: 40% urban, 60% rural
CSC, cataract surgical coverage; I, Indigenous; NI, non-Indigenous; NSW, New South Wales; NT, Northern Territory; RACO, Royal Australian College of Opthalmologist; SA, South Australia; VA, visual acuity; VIC, Victoria; VL, vision loss; WA, Western Australia.

rates of 3.4% and 0.5% in Indigenous and non-Indigenous cohorts, respectively—highly skewed compared with the other more recent studies (online supplemental figure S1). Given the date of the study, the NTEHP results are considered unlikely to be reflective of the contemporary prevalence in Australia, and hence were only included in the subgroup analysis of prevalence pre-2000 and post-2000. CSC was lower in the Indigenous (68.0%; 95% CI, 55.9 to 79.0) than non-Indigenous (88.4%; 95% CI, 79.9 to 94.8) subgroup (p=0.004) (figure 3).

There were no differences in the pooled prevalence of bilateral vision loss or blindness from cataract or CSC between rural and urban subgroups, which contained a mix of Indigenous and non-Indigenous participants (table 2). With regard to temporality, there were no differences in pooled prevalence of any vision loss or blindness from cataract or CSC between pre-2000 and post-2000 studies (online supplemental table S2). However, this should be interpreted cautiously as the NTEHP was the only pre-2000 study which included Indigenous adults, and it only contributed data to the estimate of bilateral blindness. In comparison, post-2000 studies were either wholly Indigenous or partly Indigenous.

The prevalence of cataract subtypes, regardless of VA, was explored qualitatively (online supplemental table S3). The Central Australian Ocular Health Study (CAOHS) reported that 21% of Indigenous adults living in rural Australia had a PSC occupying≥5% of the lens area.[4] In comparison, a PSC occupying≥1% of the lens affected 6.0%–6.3% of non-Indigenous participants of the Blue Mountains Eye Studies (BMES I and BMES II). A comparison with the Melbourne Visual Impairment Project (MVIP) (rate of 4.1%) was not possible as a different definition was used (opacity≥1 mm^2). The use of different grading systems across studies prevented comparisons of other subtypes.

Quality assessment and sensitivity analysis

Risk of bias assessments for Indigenous and non-Indigenous subgroups are shown in online supplemental figure S2 and table S4, respectively. There was no difference in mean quality scores between the two subgroups (62% vs 67%, p=0.71). All studies performed poorly on coverage of the identified sample (checklist item 5), including no assessment of coverage bias[16 19] or differences in responders compared with non-responders which may have affected the prevalence of visually significant cataract (eg, a higher proportion of responders who were elderly,[3 4] non-English speaking,[17] less educated,[3] or who had visual symptoms,[4] vision loss[14] or diabetes[4]). While most studies used valid diagnostic methods, only two indicated this method was applied in a consistent manner (item 7).[15 17] The remaining studies did not report the qualifications of those making the diagnosis,[19 20] lacked good interobserver agreement[4 16 18] or did not measure interobserver agreement[3 14]. Three out of five Indigenous studies used non-probabilistic sampling based on voluntary presentation after invitations were distributed within

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Table 2 Pooled prevalence estimates of visually significant cataract and cataract surgical coverage by Indigenous status and location

Outcomes by subgroup	No of studies	No of participants	Pooled prevalence % (95% CI)	Heterogeneity I^2 (%)	P value
Unilateral VL					
Indigenous status					0.891
Indigenous	3	4716	3.5 (1.1 to 7.0)	97.0	
Non-Indigenous	4	10 369	3.6 (2.2 to 5.4)	93.2	
Location					–
Rural	1	1809	6.6 (5.6 to 7.9)	–	
Urban	2	7154	4.6 (4.1 to 5.1)	–	
Unilateral blindness					
Indigenous status					0.211
Indigenous	4	5636	1.16 (0.15 to 3.02)	96.0	
Non-Indigenous	5	12 484	0.35 (0.16 to 0.60)	68.9	
Location					0.084
Rural	2	2729	2.24 (0.39 to 5.48)	–	
Urban	2	7154	0.53 (0.29 to 0.85)	–	
Bilateral VL					
Indigenous status					**0.011**
Indigenous	3	4716	3.6 (1.8 to 6.1)	94.0	
Non-Indigenous	6	17 228	1.1 (0.6 to 1.8)	92.5	
Location					0.382
Rural	3	4490	2.6 (0.2 to 7.3)	98.2	
Urban	4	10 542	1.1 (0.3 to 2.3)	94.1	
Bilateral blindness					
Indigenous status					**0.002**
Indigenous	4	5636	0.385 (0.121 to 0.782)	72.8	
Non-Indigenous	6	17 228	0.001 (0.000 to 0.047)	54.9	
Location					0.183
Rural	3	4202	0.23 (0.00 to 0.95)	98.6	
Urban	3	10 425	0.02 (0.00 to 0.07)	5.9	
CSC					
Indigenous status					**0.004**
Indigenous	3	4716	68.0 (55.9 to 79.0)	88.0	
Non-Indigenous	5	17 092	88.4 (79.9 to 94.8)	95.0	
Location					0.323
Rural	3	4490	73.0 (51.1 to 90.2)	94.8	
Urban	4	10 542	84.5 (74.9 to 92.3)	85.4	

VL, vision loss; CSC, cataract surgical coverage

the community (item 2),[4 14 19] compared with one out of seven non-Indigenous studies[14]. These same studies had low response rates (item 9; range of 23%–50%), another area which the Indigenous subgroup appeared to underperform compared with the non-Indigenous subgroup. The overall quality of evidence for Indigenous and non-Indigenous estimates was moderate for unilateral and bilateral vision loss and CSC, and low for unilateral and bilateral blindness (online supplemental table S5).

Sensitivity analysis revealed that low-quality studies reported higher rates of unilateral vision loss and blindness from cataract (online supplemental table S6). Low-quality studies mainly differed from high-quality studies in use of inappropriate sampling techniques (3/6

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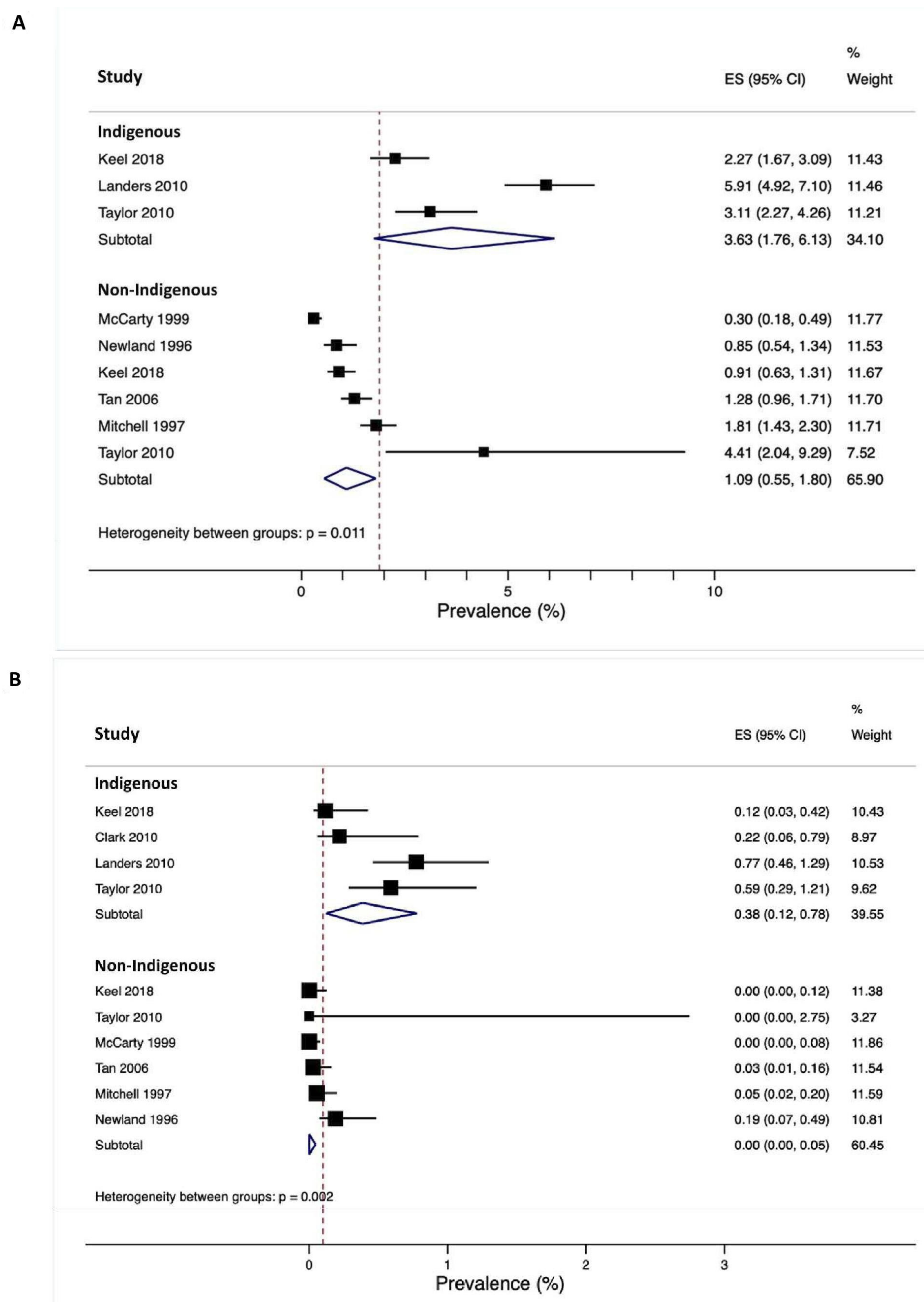

Figure 2 Forest plots of the prevalence of bilateral vision loss (A) and bilateral blindness (B) from cataract in Indigenous and non-Indigenous subgroups.

studies vs 0/3 studies, respectively), no national sample frame (6/6 vs 1/3) and poor response rates (4/6 vs 0/3).

DISCUSSION

We report that visually significant cataract is common in both urban and rural Australia, with Indigenous Australians more likely to have advanced cataract causing bilateral vision loss or blindness and lower surgical coverage. These findings appear stable over time, with no difference in results when comparing studies before and after the year 2000—although important limitations of this temporal trend analysis are discussed below. To the best of our knowledge, this is the first systematic review and meta-analysis of cataract in Australia, and it supports the need for strategies to reduce the burden of vision loss from cataract, particularly in Indigenous populations.

Cataract in Non-Indigenous Australians

Our prevalence estimates for bilateral vision loss and blindness from cataract in non-Indigenous Australians (1.1% and 0.001%, respectively) are similar to estimates for other developed regions as reported in the Vision Loss Expert Group's 2020 meta-analysis, despite the broader definitions used in our study.[1 2] In the North American region (Canada and the USA), the crude prevalence of bilateral visual impairment (VA<6/18 and≥3/60) and

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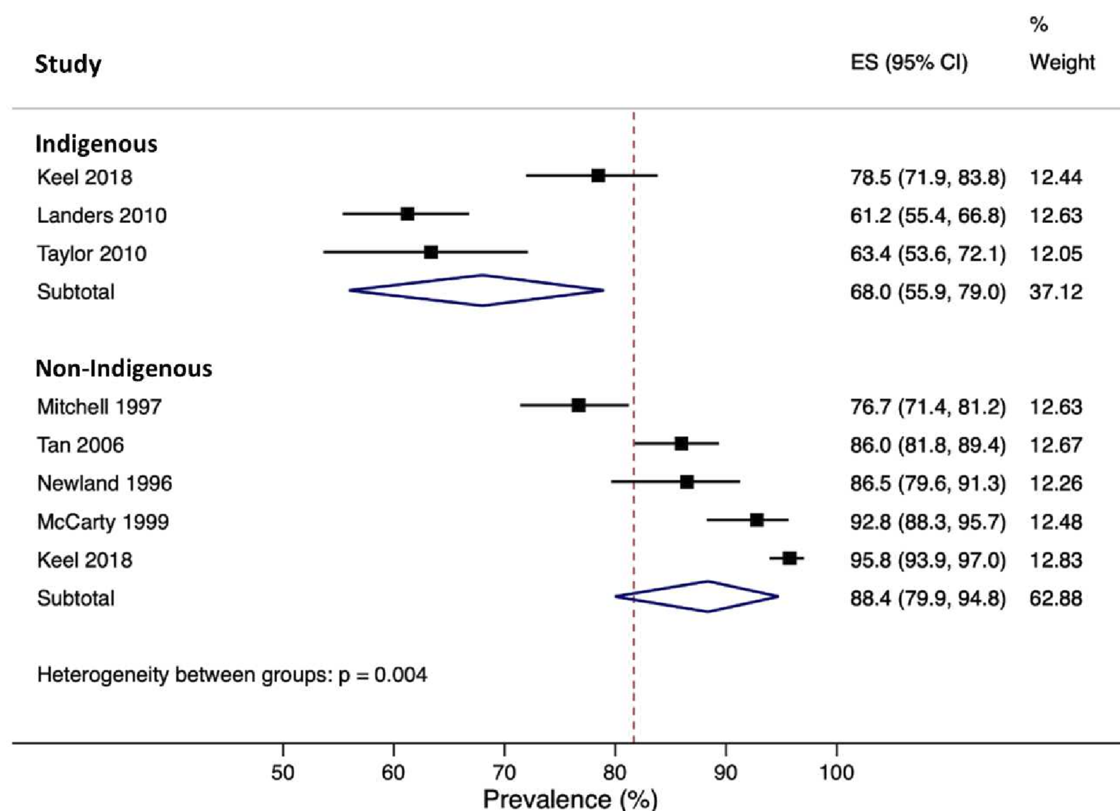

Figure 3 Forest plot of cataract surgical coverage for Indigenous and non-Indigenous subgroups.

blindness (VA<3/60) from cataract in adults 50 years and older is 1.3% and 0.11%, respectively. These rates are 1.8% and 0.11% in the high-income Asian Pacific region, and 2.3% and 0.09% in the Western European region. By comparison, the global rates of 4.2% and 0.80% are substantially higher than our estimates.[1] This is unsurprising given the inverse relationship between a nation's socioeconomic indices and cataract prevalence.[21] Unilateral vision loss from cataract is infrequently reported, limiting comparisons with other studies. One study from Iceland reported a lower rate of unilateral vision loss (1.9% vs 3.6% in our study), but a similar rate of unilateral blindness (0.29% vs 0.35% in our study).[22]

Our subgroup analysis found no change in the prevalence of visually significant cataract since the year 2000. However, this finding should be interpreted cautiously as Indigenous adults were under-represented in pre-2000 studies. Any temporal trend in prevalence may have been masked by this difference in composition of pre- and post-2000 study populations.

Applying our estimates to census data suggests that approximately 130 000 non-Indigenous Australians over 40 years of age have bilateral vision loss from cataract.[23] Approximately 430 000 have unilateral vision loss, including 40 000 with unilateral blindness from cataract. Untreated visually significant cataract is associated with significant morbidity and mortality, and incurs substantial direct and indirect costs to the Australian society, estimated at $1.6 billion per year.[24] Treatment through cataract surgery is among the most cost-effective healthcare interventions, requiring an investment of only AUD$4378 per quality-adjusted life-year gained.[25] Increasing the accessibility of surgery for Australians with visually significant cataract would improve their quality of life while yielding substantial economic gains for society.

Cataract in Indigenous Australians

In the 1970s, the NTEHP reported that 1 in 30 Indigenous Australians over 40 years old were bilaterally blind from cataract. In contrast, our pooled estimate of more recent studies indicates that 1 in 260 are bilaterally blind from cataract. The most recent population survey (NEHS) suggests that this rate is 1 in 859, comparable with the lower bound of our 95% CI. While the improvement among Indigenous Australians appears reassuring, it remains substantially higher than the rate of 1 in 91 000 among non-Indigenous Australians (p=0.002), highlighting ongoing disparities in the prevalence of advanced bilateral visually significant cataract between these populations. Similarly, bilateral vision loss from cataract is over threefold higher among Indigenous compared with non-Indigenous Australians (p=0.011) and is comparable with rates observed in sub-Saharan Africa and East Asia.[1 2]

In contrast, the prevalence of unilateral vision loss was similar between Indigenous and non-Indigenous Australians. Disparities in advanced bilateral visually significant

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cataract, but not unilateral cataract, may be explained by delays in diagnosis and/or treatment among Indigenous Australians, leading to higher rates of advanced bilateral disease at later stages of life. This hypothesis is supported by multiple studies. The NEHS reported that 60% of visually significant cataract in Indigenous adults were undiagnosed compared with 45% in non-Indigenous adults.[3] Another study reported that the median preoperative VA for cataract surgery in rural public hospitals was 6/60 among Indigenous adults compared with 6/24 among non-Indigenous adults, suggesting the former experience delays in diagnosis and/or in being waitlisted for surgery.[26] Delays in diagnosis likely arise from the multiple, well-described barriers Indigenous people experience when accessing eye care services, including the lack of culturally-safe care, communication difficulties, transportation issues, cost of services (real or perceived), difficulties navigating complex referral pathways and misconceptions about eye health.[27–30] Once listed for public surgery, Indigenous Australians experience longer wait times (national median of 169 days vs 132 days).[31] Furthermore, due to financial barriers, Indigenous Australians are less likely to have private health insurance than non-Indigenous Australians.[32] Consequently, a smaller proportion of Indigenous compared with non-Indigenous Australians undergo cataract surgery in private hospitals (21.5% vs 70.1%),[33] where surgeries typically occur within weeks of waitlisting.[34] The possibility of a higher incidence of visually significant cataract in Indigenous Australians cannot be excluded. This is supported by the CAOHS, which reported that the annual incidence of bilateral vision loss from cataract among Indigenous Australians is 1.9%,[35] compared with 0.06% and 0.18% among non-Indigenous Australians reported by the MVIP[36] and BMES,[37] respectively. As suggested by the CAOHS, this may occur due to their greater exposure to cataractogenic risk factors, including diabetes and smoking. Future studies on the incidence of visually significant cataract should explore this possibility further. A higher incidence of cataract combined with delays in diagnosis and treatment could contribute to the lower CSC for Indigenous Australians identified in our study and in the NEHS's within-study comparison.[3] The CSC for Indigenous Australians in our study (68%) is comparable with Kuala Lumpur and neighbouring cities (70%),[38] despite Australia's substantially higher Human Development Index.

Indigenous Australians appear to have very high rates of PSC, which may relate to a high prevalence of diabetes, a well-known risk factor for PSC formation.[4] Comparisons of other cataract subtypes were not possible as different grading systems were used across studies, highlighting the need to adopt a global standard in the definition of cataract subtypes.[39]

Over the last decade, substantial effort has been made to improve the eye health of Indigenous Australians through initiatives such as the Roadmap to Close the Gap for Vision.[30] Ongoing work in this area is guided by initiatives such as Vision 2020's Strong Eyes, Strong Communities 5 year plan.[40] Many recommendations in this plan would facilitate earlier diagnosis of visually significant cataracts, such as embedding eye care within Aboriginal Community Controlled Organisations (ACCHOs) including onsite optometrists and ophthalmologists, interlinking ACCHOs with mainstream optometry and ophthalmology services, and improved cultural safety and accessibility of mainstream services. Other strategies would improve access to surgery for diagnosed cataracts, including increased public surgery lists and the implementation of a 90-day maximum wait for Indigenous Australians. Ongoing government support is needed to implement and evaluate these strategies,[41] which could improve surgery coverage and reduce the higher burden of visually significant cataract experienced by Indigenous Australians.

Limitations

Most studies did not state whether bilateral vision loss or blindness from cataract was based on both eyes being affected by cataract (as opposed to another ophthalmic condition), or just the better eye. Nevertheless, both classifications represent clinically important bilateral vision loss correctable with surgery. While all studies performed retinal examinations, these may have been limited in cases where significant cataract obstructed the view of the retina. In some of these cases, it is possible that cataract surgery alone might not have fully restored vision due to the presence of an underlying retinal pathology. Nevertheless, to the best of our knowledge, the definitive way to rule out the presence of such a pathology is through a repeated retinal examination after cataract surgery, which is not feasible within the scope of prevalence studies. Inclusion of the NEHS may have underestimated the prevalence of unilateral blindness, as this study only included cases of unilateral blindness when the better seeing eye had no degree of vision loss (VA≥6/12). There was insufficient data to calculate effective CSC, which measures the number of people who have been operated on for cataract, and had a good visual outcome, as a proportion of all people operated on or requiring surgery.[11] There were an insufficient number of studies to perform prespecified subgroup analyses or meta-regression based on age, gender, education levels and prior eye examinations. Adjusting for age may have revealed a greater disparity in the prevalence of visually significant in the Indigenous subgroup, given the mean ages for the Indigenous cohorts included in the study were lower than the non-Indigenous cohorts. Most of our meta-analyses had considerable heterogeneity, but this is expected given the nature of proportional data and should be interpreted conservatively.[13] Finally, our sensitivity analysis suggests lower quality studies may have overestimated cataract prevalence. Future research should use nation-wide sampling and strategies to improve response rates, which will facilitate more accurate prevalence estimates.

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CONCLUSIONS

Cataract is a common cause of vision loss among adults in both rural and urban parts of Australia. Indigenous Australians are disproportionately affected by bilateral vision loss and blindness from cataract and experience low surgical coverage. Further high-quality research with nation-wide sampling should identify factors contributing to these disparities, including an exploration of differences in the risks and incidence of visually significant cataract among Indigenous and non-Indigenous Australians. Government support to increase cataract diagnosis and surgical coverage is needed to reduce the significant burden of this treatable condition.

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