



The Prevalence and Causes of Vision Loss in Indigenous and Non-Indigenous Australians

The National Eye Health Survey

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Purpose: To conduct a nationwide survey on the prevalence and causes of vision loss in Indigenous and non-Indigenous Australians.

Design: Nationwide, cross-sectional, population-based survey.

Participants: Indigenous Australians aged 40 years or older and non-Indigenous Australians aged 50 years and older.

Methods: Multistage random-cluster sampling was used to select 3098 non-Indigenous Australians and 1738 Indigenous Australians from 30 sites across 5 remoteness strata (response rate of 71.5%). Sociodemographic and health data were collected using an interviewer-administered questionnaire. Trained examiners conducted standardized eye examinations, including visual acuity, perimetry, slit-lamp examination, intraocular pressure, and fundus photography. The prevalence and main causes of bilateral presenting vision loss (visual acuity <6/12 in the better eye) were determined, and risk factors were identified.

Main Outcome Measures: Prevalence and main causes of vision loss.

Results: The overall prevalence of vision loss in Australia was 6.6% (95% confidence interval [CI], 5.4–7.8). The prevalence of vision loss was 11.2% (95% CI, 9.5–13.1) in Indigenous Australians and 6.5% (95% CI, 5.3–7.9) in non-Indigenous Australians. Vision loss was 2.8 times more prevalent in Indigenous Australians than in non-Indigenous Australians after age and gender adjustment (17.7%, 95% CI, 14.5–21.0 vs. 6.4%, 95% CI, 5.2–7.6, $P < 0.001$). In non-Indigenous Australians, the leading causes of vision loss were uncorrected refractive error (61.3%), cataract (13.2%), and age-related macular degeneration (10.3%). In Indigenous Australians, the leading causes of vision loss were uncorrected refractive error (60.8%), cataract (20.1%), and diabetic retinopathy (5.2%). In non-Indigenous Australians, increasing age (odds ratio [OR], 1.72 per decade) and having not had an eye examination within the past year (OR, 1.61) were risk factors for vision loss. Risk factors in Indigenous Australians included older age (OR, 1.61 per decade), remoteness (OR, 2.02), gender (OR, 0.60 for men), and diabetes in combination with never having had an eye examination (OR, 14.47).

Conclusions: Vision loss is more prevalent in Indigenous Australians than in non-Indigenous Australians, highlighting that improvements in eye healthcare in Indigenous communities are required. The leading causes of vision loss were uncorrected refractive error and cataract, which are readily treatable. Other countries with Indigenous communities may benefit from conducting similar surveys of Indigenous and non-Indigenous populations. *Ophthalmology* 2017;■:1–10 © 2017 by the American Academy of Ophthalmology

Globally, approximately 223 million people experience vision loss,¹ in whom 80% of cases are avoidable through early detection, prevention, and treatment.² The feasibility of reducing the burden of vision loss prompted the World Health Assembly to endorse “Universal Eye Health: A Global Action Plan 2014–2019” (the Global Action Plan) in 2013, which aimed to reduce the prevalence of avoidable blindness by 25% before the year 2020.³ The World Health Assembly emphasized the need for population-based survey data on the prevalence and causes of vision loss to inform resource allocation for eye

healthcare services to achieve the objectives of the Global Action Plan.³

Less than 20% of countries have conducted nationwide surveys on the prevalence and causes of vision loss, and existing studies vary in terms of methodological rigor.² In this article, we contend that the methods used in most surveys to date are limited in their ability to provide a sufficiently detailed map of a nation’s eye health, particularly in countries with disadvantaged Indigenous groups. The definition of indigeneity is contentious and varies considerably; however, the United Nations

Permanent Forum on Indigenous Issues loosely defines Indigenous peoples on the basis of the following criteria: (1) self-identification as Indigenous peoples by individuals and acceptance as such by their community; (2) historical continuity and land occupation before invasion and colonization; (3) strong links to territories including land and water and related natural resources; (4) distinct social, economic, or political systems; (5) distinct language, culture, religion, ceremonies, and beliefs; (6) tendency to form nondominant groups of society; (7) resolution to maintain and reproduce ancestral environments and systems as distinct peoples and communities; and (8) tendency to manage their own affairs separate from centralized state authorities.⁴ There are 370 million Indigenous people in 90 countries, and they consistently experience significantly poorer health outcomes than their non-Indigenous counterparts.^{5,6} This gap is particularly pronounced in developed nations with historically colonized Indigenous minorities, including the United States, Canada, New Zealand, and Australia, where Indigenous morbidity and mortality rates are higher than in many developing nations.⁷ Considering that vision loss is more prevalent in disadvantaged communities,⁸ it follows that many Indigenous populations are likely to have a higher burden of vision loss. Nationwide studies have been conducted in regions of Asia, Africa, and Europe with Indigenous populations, but none have attempted to collect samples from Indigenous groups.^{9–22} By assuming ethnic homogeneity and neglecting to interrogate Indigenous communities, these surveys may have insufficiently quantified the burden of vision loss in some of their countries' most vulnerable groups. Consequently, they may have underestimated the prevalence of vision loss and generated data that are insufficient to optimally inform national interventions.

With the exception of 2 surveys conducted in Australia,^{23,24} all surveys investigating Indigenous eye health have been subnational and focused on isolated tribes or communities with varying degrees of sampling bias,^{25–33} and most did not make robust comparisons with non-Indigenous groups^{25,27,28,30,33} or collect comprehensive ophthalmic data.^{29,30} Nevertheless, the majority of these surveys, in conjunction with other research, have found that Indigenous communities in Brazil, Ecuador, United States, and Australia have high rates of vision loss^{24,34,35} and eye disease, including trachoma,^{30,36} cataract,²⁵ pterygium,^{25,37} and diabetic retinopathy.²⁴ Therefore, because Indigenous peoples constitute more than 5% of the global population,⁷ identifying the prevalence and causes of vision loss in these groups in conjunction with general populations is critical to inform national eye health programs and to achieve the objectives of the Global Action Plan.

Australia requires national prevalence data on vision loss to fulfill its obligations as a signatory to the Global Action Plan. State-level surveys conducted in the early 1990s in Victoria,³⁸ New South Wales,³⁹ and South Australia⁴⁰ have been the reference studies in Australia until now. We conducted a nationwide study, the National Eye Health Survey (NEHS), to determine the prevalence and causes of vision loss in Australia. This survey has implemented a

novel approach to stratifying its sampling frame according to Indigenous status to produce reliable estimates of the prevalence and causes of vision loss in both Indigenous and non-Indigenous populations. We present the findings of the NEHS and propose that our stratified study design forms the basis for future prevalence studies in all countries with Indigenous groups.

Methods

Study Design and Participants

The sampling methodology of the NEHS has been described in detail.⁴¹ In brief, the target population was stratified into Indigenous Australians and non-Indigenous Australians. In accordance with Global Action Plan guidelines, the NEHS recruited non-Indigenous Australians aged 50 years or older.³ However, because Indigenous Australians have earlier onset and more rapid progression of eye disease and diabetes,⁴² a younger age of 40 years or older was selected. On the basis of the most reliable previous estimates of the prevalence of vision loss in Australia,^{24,43} the required sample size was 2794 non-Indigenous Australians and 1368 Indigenous Australians residing in 30 geographic areas.

Multistage random-cluster sampling was used to select participants on the basis of data from the 2011 Australian Census.⁴⁴ In stage 1 of sampling, the Australian population was stratified into 5 remoteness strata: Major City, Inner Regional, Outer Regional, Remote, and Very Remote. Probability proportional to size sampling was used to select 12 Major City, 6 Inner Regional, 6 Outer Regional, 4 Remote, and 2 Very Remote survey sites, corresponding to the approximate population distribution in each stratum. In the second stage, a smaller cluster containing approximately 100 eligible residents was randomly selected and nominated as the enumeration site. Because of a number of factors including insufficient population numbers, inaccurate Census data, and high absentee rates, a systematic approach was used to make adjustments to some sites, including the use of backup sites and sampling from contiguous geographic areas. The details of this approach have been published.⁴¹ Door-to-door recruitment was conducted until approximately 100 non-Indigenous participants were recruited from each cluster. Although door-to-door recruitment was used for the majority of participants, we consulted Aboriginal elders and local Aboriginal Health Services to ensure that our recruitment methods were culturally appropriate. In some instances, direct door-to-door recruitment was deemed culturally inappropriate, and telephone recruitment from formalized community lists was used as a substitute. Household recruitment, including door-to-door and telephone recruitment, accounted for approximately 80% of Indigenous recruitment. Alternative methods of contact included concurrent Indigenous health clinics and word of mouth.

The protocol was approved by the Royal Victorian Eye and Ear Hospital Human Research Ethics Committee, as well as state-based Indigenous ethics organizations. This study was conducted in accordance with the tenets of the Declaration of Helsinki.

Procedures

The examination protocol of the NEHS has been described in detail.⁴⁵ Participant examinations were conducted in a total of 61 testing venues that included community centers, mobile clinics, town halls, Aboriginal Corporations, schools, and medical clinics, all within 6 km of each recruitment site. Examinations were conducted over 13 months and 7 days, from March 11,

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