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The prevalence of vision loss due to ocular trauma in the Australian National Eye Health Survey

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ABSTRACT

Background: To determine the prevalence of vision loss due to ocular trauma in Australia.
Methods: The National Eye Health Survey (NEHS) is a population-based cross-sectional study that examined 3098 non-Indigenous Australians (aged 50–98 years) and 1738 Indigenous Australians (aged 40–92 years) living in 30 randomly selected sites, stratified by remoteness. An eye was considered to have vision loss due to trauma if the best-corrected visual acuity was worse than 6/12 and the main cause was attributed to ocular trauma. This determination was made by two independent ophthalmologists and any disagreements were adjudicated by a third senior ophthalmologist.
Results: The sampling weight adjusted prevalence of vision loss due to ocular trauma in non-Indigenous Australians aged 50 years and older and Indigenous Australians aged 40 years and over was 0.24% (95% CI: 0.10, 0.52) and 0.79% (95% CI: 0.56, 1.13), respectively. Trauma was attributed as an underlying cause of bilateral vision loss in one Indigenous participant, with all other cases being monocular. Males displayed a higher prevalence of vision loss from ocular trauma than females in both the non-Indigenous (0.47% vs. 1.25%, p = 0.03) and Indigenous populations (0.12% vs. 0.38%, p = 0.02). After multivariate adjustments, residing in Very Remote geographical areas was associated with higher odds of vision loss from ocular trauma.
Conclusions: We estimate that 2.4 per 1000 non-Indigenous and 7.9 per 1000 Indigenous Australian adults have monocular vision loss due to a previous severe ocular trauma. Our findings indicate that males, Indigenous Australians and those residing in Very Remote communities may benefit from targeted health promotion to improve awareness of trauma prevention strategies.

Introduction

Ocular injuries are a leading, but avoidable, cause of monocular vision loss globally [1]. In Australia, there are an estimated 20,000 hospitalisations due to ocular injury annually, [2] at a direct cost of $155 million [3]. Indigenous Australians [2], males [4] and individuals residing in rural areas [5–7] have consistently been reported to be at a higher risk of ocular trauma. Despite the notable public health concern, recent population-based data on the frequency of severe ocular trauma in Australian adults remains limited.

Most data on ocular injury in Australia comes from hospital-based reports [2,3,8,9]. To date, the most robust population-based data can be derived from the Melbourne Visual Impairment Project (VIP) [4] and the Blue Mountains Eye Study (BMES) [10] conducted in the early 1990's that reported the prevalence of monocular vision loss (<6/12) due to ocular trauma to be 0.25% and 0.33%, respectively. More recent data from the National Indigenous Eye Health Survey (NIEHS, 2008) [11] and the Central Australian Ocular Health Study (CAOHS, 2010) [12] suggest that the burden of ocular injury is notably higher amongst Indigenous Australian adults, with nearly one-third of all monocular blindness attributed to injury. This is in line with national hospital-based data that have reported three-fold higher rates of hospitalised ocular injuries amongst Indigenous Australians than non-Indigenous Australians [2].

Herein, we describe the prevalence and causes of vision loss due to ocular trauma in a national, population-based sample of non-Indigenous and Indigenous Australian adults aged 50 years or older and 40 years or older, respectively.

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Materials and methods

Study population

The NEHS is a population-based, cross-sectional survey conducted between the 11th of March 2015 and 18th of April 2016. Details of the sampling methodology have been described in detail elsewhere [13]. Multistage random-cluster sampling was used to select thirty Australian sites across five Remoteness Areas (RAs) that included Major City, Inner Regional, Outer Regional, Remote and Very Remote geographical areas, based on data from the 2011 Australian Census [14]. The Australian Bureau of Statistics assigns a remoteness classification to a Statistical Area according to the Accessibility/Remoteness Index of Australia (ARIA+) classification system. ARIA+ scores range from 0 to 15 along a continuous scale based on road distances between Statistical Areas and their nearest service centres (e.g. ARIA+ of >10.53–15.00 = Very Remote). Indigenous Australians aged 40 years or older and non-Indigenous Australians aged 50 years or older were recruited door-to-door (examination rate = 71.5%). The younger age criteria for Indigenous participants was chosen due to the earlier onset and more rapid progression of common eye diseases and diabetes in Indigenous Australians [15], coupled with a lower life expectancy [16]. The protocol was approved by the Royal Victorian Eye and Ear Hospital Human Research Ethics Committee (HREC-14/1199H) as well as State-based Indigenous organisations. Study procedures adhered to the tenets of the Declaration of Helsinki as revised in 2013 and participants provided written informed consent to participate.

Examination procedures

The examination protocol of the NEHS has been described in detail elsewhere [17]. Socio-demographic data including age, gender, Indigenous status, ethnicity, years of education and language spoken at home were collected via an interviewer-administered questionnaire. Participants self-reported whether they had ever been told that they have cataracts, age-related macular degeneration (AMD), diabetic retinopathy (DR), glaucoma. Further to this, participants self-reported whether they had any 'other' ocular history, including ocular or adnexal (e.g. eyelids) trauma, and if so they were prompted for the details about the cause.

Presenting distance visual acuity (VA) was measured in each eye using a logMAR chart (Brien Holden Vision Institute, Australia) in well-lit room conditions. Pinhole testing was performed on participants with visual acuity worse than 6/12 in one or both eyes, followed by automated refraction (Nidek ARK-30 Type-R Hand-held auto-refractor/keratometer, Nidek Co., LTD, Japan) if VA improved to 6/12 or better in either eye. Examination of the anterior segment was performed using a hand-held slit lamp (Keeler Ophthalmic Instruments, UK) at 10× magnification. Participants with VA worse than 6/12 in either or both eyes had anterior segment photographs taken of the impaired eye(s) using a Digital Retinography System (DRS) camera (CenterVue SpA, Italy). Two-field, 45° colour fundus photographs were taken of each retina using the DRS camera, centred on the macula and optic disc, respectively, in a darkened room to allow for physiological mydriasis. De-identified images were transferred to the retinal image grading centre at the Centre for Eye Research Australia (CERA), where blinded retinal graders graded images according to protocols that have been described in detail elsewhere [18–20].

An eye was considered to have visual impairment due to trauma if best-corrected distance VA was <6/12-6/60 due to trauma. If VA was worse than 6/60 due to trauma, this was considered to be blindness due to trauma. The term vision loss incorporated both visual impairment and blindness, defined as a best-corrected VA of <6/12. The determination of whether the loss was due to trauma was made by two independent ophthalmologists who reviewed relevant questionnaire and clinical data. Any disagreements were adjudicated by a third senior ophthalmologist.

Statistical analysis

Bivariate descriptive statistics were utilized to test for statistically significant differences in all study variables between participants who experienced ocular injuries versus those who did not. Chi-square tests for homogeneity were used to test for differences in categorical variables; two-tailed Student's *t*-tests were used to test for differences in continuous variables. The occurrence of ocular injury is a rare event. The main issue of logistic regression with the rare event data is a serious bias problem in regression coefficient estimates. So the sampling weight-adjusted prevalence rates of vision loss from ocular injury were estimated using Poisson distribution for rare event, stratified by Indigenous status. Poisson regression was used to assess differences in the prevalence rates of vision loss from ocular injury by gender, age, education, and geographic location, mutually adjusting for each of these factors in a multivariable model. Incidence rate ratios (IRR) and their estimated 95% confidence intervals (CI) were estimated from the Poisson regression analyses. All analyses were performed by incorporating the sampling weights and non-response rates to obtain unbiased estimates from the complex NEHS sampling design. Analyses were conducted in Stata 14.2.0 (StataCorp). A $P < 0.05$ (two-tailed) was deemed statistically significant.

Results

A total of 4836 individuals were examined in the NEHS, including 3098 non-Indigenous and 1738 Indigenous Australians, respectively. The sample of non-Indigenous Australians had a mean age of 66.6 years (SD = 9.7 years) while the mean age of Indigenous participants was 55.0 years (SD = 10 years). Non-Indigenous Australians were 46% male and Indigenous Australians were 41% male.

Self-reported history of ocular trauma

Overall, 63 (2.0%) non-Indigenous Australians aged 50 years or over and 70 (4.0%) Indigenous Australians aged 40 years or over

Table 1
Prevalence [(% (95% CI)] of vision loss from ocular injury, stratified by Indigenous status.

	Non-Indigenous (n = 3098)			Indigenous (n = 1738)		
	n	Crude% (95% CI)	Weighted% (95% CI)	n	Crude% (95% CI)	Weighted% (95% CI)
Total	10	0.32 (0.17, 0.60)	0.24 (0.10, 0.52)	12[a]	0.69 (0.39, 1.22)	0.79 (0.56, 1.13)
Female	2	0.12 (0.03, 0.48)	0.47 (0.10, 2.10)	3	0.29 (0.09, 9.08)	0.12 (0.02, 0.59)
Male	8	0.56 (0.28, 1.11)	1.25 (0.58, 2.70)	9	1.26 (0.66, 2.42)	0.38 (0.16, 0.94)

CI = Confidence Interval.
[a] 1 Indigenous Australian had binocular vision loss from ocular injury.

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