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RESEARCH

Gender and ethnic differences in pterygium prevalence: an audit of remote Australian clinics

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Aisling B McGlacken-Byrne* MB BCh BAO
Jocelyn J Drinkwater[†] MPH
David A Mackey*[‡] MD FRANZCO
Angus W Turner*[‡] MSc FRANZCO

*Lions Outback Vision, Lions Eye Institute, Perth, Australia
[†]School of Medicine, The University of Western Australia, Perth, Australia
[‡]Centre of Ophthalmology and Visual Science, The University of Western Australia, Perth, Australia
E-mail: 08724911@ucdconnect.ie

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Clinical relevance: Developing an accurate picture of the demographic profile and refractive status of Aboriginal and non-Aboriginal individuals with pterygium will facilitate health planning and appropriate deployment of health-care resources in rural Australia.

Background: To date, there is a paucity of reports in the literature regarding Aboriginal ocular health and refractive error. This study examines clinical data from a rural ophthalmology outreach clinic – a predominantly Aboriginal population.

Methods: An assessment was undertaken of data of 293 patients noted to have pterygium present in at least one eye, from a sample of 2,072 individuals seen in rural northern Western Australia in 2017 by the Lions Outback Vision Visiting Optometry Service.

Results: Pterygium was found in 14.1 per cent (n = 293) of patients using the Lions Outback Vision service. The mean age of those with pterygium (n = 293) was 57.1 ± 11.9 years (mean ± standard deviation); 188 were female (64.1 per cent); 260 identified as Aboriginal (88.7 per cent), 22 identified as non-Aboriginal (7.5 per cent) and 11 did not specify (3.8 per cent). There were more males than females with pterygium in the non-Aboriginal group (18.0 per cent versus 6.4 per cent); however, the reverse was true in the Aboriginal group (11.7 per cent versus 17.0 per cent). Analysis of the subjective refractive data in those with pterygium revealed an overall mean spherical equivalent value of +0.66 ± 1.28 DS. The median (interquartile range) best-corrected visual acuity was 0.0 (–0.1 to 0.0) logMAR (6/6 Snellen equivalent).

Conclusions: This paper increases our knowledge of ocular health in a remote Australian population, with an emphasis on the differences between Aboriginal and non-Aboriginal individuals, males and females.

Key words: Aboriginal, indigenous, myopia, pterygium

Pterygium is a triangular growth of fibrovascular tissue, extending from the limbus to involve the cornea.[1] This condition is more prevalent in regions on or around the equator, where sun exposure is more intense.[2] The sample population investigated here was from a near equatorial region with intense sun exposure. Refractive error is also linked to sun exposure; myopia is associated with indoor occupations and lower exposure to sunlight and hyperopia is more common in people who spend more time outdoors.[3–6]

There is a paucity in the literature discussing Aboriginal refractive errors. Evidence from various countries and ethnicities indicates that the global prevalence of myopia is increasing.[7] The hypothesised inverse relationship between myopia and pterygium will be discussed.

Methods

Clinical data was reviewed of 2,072 patients seen by the Visiting Optometry Service in 2017, as part of the Lions Outback Vision – a part of the Lions Eye Institute, which provides visiting ophthalmology outreach services for residents in rural areas of Western Australia. This program aims to tackle the inequity of access to surgery for Indigenous Australians.

The study was granted exemption for ethics application by the University of Western Australia given the retrospective and de-identified nature of the data.

Information was analysed from the electronic patient database of the optometry section using FileMaker Pro (v17, Filemaker Inc., Santa Clara, CA, USA). Clinical notes were reviewed from patients of all ages from rural locations in Western Australia. Attending patients included those from diabetic screening as well as new referrals and review patients. Demographic details such as age, gender and ethnicity were recorded. Ethnicity was self-reported by patients at the time of clinic registration as either 'Aboriginal' or 'non-Aboriginal'.

'Pterygium' was documented by the examining optometrist in the clinical details or 'diagnosis' section of the patient record in 293 of 2,072 patients (14.1 per cent). Further descriptive details such as side, unilateral/bilateral, site or severity, were not included in this analysis. Those with pterygium present in either eye were included in the study, irrespective of nasal/temporal location or whether they presented with monocular versus binocular pterygia. Both eyes from these patients were included in refractive examination. Best-corrected visual acuities were converted to logMAR scales for calculating means and were reported as Snellen equivalents.

Refractive data of the participants were collected using subjective refraction, retinoscopy and corrective lens measurement. Emmetropia was defined as mean spherical equivalent (MSE) between −0.50 DS and +0.50 DS.[8,9] Myopia was defined as MSE < −0.50 DS and MSE < −6.00 DS was classified as high myopia. Hyperopia was defined as MSE > +0.50 DS. Anisometropia was defined at two levels; difference in spherical equivalent between eyes being > 0.50 DS and > 1.00 DS. Astigmatism was defined as a cylindrical error ≥ −0.50 DC.

Statistical analyses were conducted using IBM SPSS Statistics for Windows (Version 25.0, IBM Corp., Armonk, NY, USA). Data are presented as proportions: mean ± standard deviation, or median (interquartile range). For two-way comparisons for independent samples, categorical variables were by Fisher's exact test, using a two-tailed significance level of $p < 0.05$.

Results

The population of 2,072 clinic attendees in 2017 was distributed mainly in the north-west of rural Western Australia, with 69.0 per cent (n = 1,430) from the Kimberley region, 28.1 per cent (n = 583) from the Pilbara region and 2.9 per cent (n = 59) from the Goldfields region. The analysed sample was predominantly female (58.9 per cent, n = 1,221) and Aboriginal (84.7 per cent, n = 1,754).

Pterygium was found in 14.1 per cent (n = 293) of patients using the Lions Outback Vision service. The mean age of those with pterygium (n = 293) was 57.1 ± 11.9 years (mean ± standard deviation) (range 27–90); 188 were female (64.1 per cent); 260 identified as Aboriginal (88.7 per cent), 22 identified as non-Aboriginal (7.5 per cent) and 11 did not specify (3.8 per cent). There were more males than females with pterygium in the non-Aboriginal group (18.0 per cent, n = 14 versus 6.4 per cent, n = 8); however, the reverse was true in the Aboriginal group (11.7 per cent, n = 85 versus 17.0 per cent, n = 175) ($p = 0.002$). In this sample, prevalence was higher in Aboriginal compared to non-Aboriginal individuals (14.8 per cent, n = 260 versus 10.8 per cent, n = 22) ($p = 0.005$) (Table 1).

The spherical equivalent was +0.71 DS ± 1.18 for the right eye and +0.56 DS ± 1.32 for the left eye, with an overall MSE in this sample of +0.66 DS ± 1.28. MSE was +0.64 DS ± 1.30 for Aboriginal and +0.53 DS ± 0.89 for non-Aboriginal individuals. Prevalence rates of myopia, high myopia, emmetropia and hyperopia in individuals with pterygium were 8.9 per cent (n = 26), zero per cent (n = 0), 38.6 per cent (n = 113) and 42.3 per cent (n = 124), respectively. In Aboriginal people, the respective rates were 10.5 per cent (n = 25), zero per cent (n = 0), 43.5 per cent (n = 103) and 46.0 per cent (n = 109). Anisometropia of > 1.0 DS was found in 12.6 per cent (n = 31) of patients and anisometropia of > 0.5 ≤ 1.0 DS was found in 12.6 per cent (n = 31) of patients.

	Males with pterygium (%)	**Females with pterygium (%)**	**Total with pterygium (%)**
Aboriginal	85 (29.0)	175 (59.8)	260 (88.7)
Non-Aboriginal	14 (4.8)	8 (2.7)	22 (7.5)
Not specified	6 (2.0)	5 (1.7)	11 (3.8)
Total	105 (36.8)	188 (64.1)	293 (100)
	Males in clinic population	**Females in clinic population**	**Total in clinic population**
Aboriginal	727	1,027	1,754
Non-Aboriginal	78	125	203
Not specified	46	69	115
Total	851	1,221	2,072

Table 1. Demographics of gender and ethnicity in the sample

Astigmatism was present in 66.9 per cent (n = 176) of patients in at least one eye and 35.0 per cent (n = 92) had bilateral astigmatism. The median (interquartile range) best-corrected visual acuity for patients was 0.0 (−0.1 to 0.0) logMAR (6/6 Snellen equivalent).

Discussion

The prevalence of pterygium varies greatly between and sometimes even within populations.[2] Pterygium is associated with living at equatorial latitudes and with exposure to ultraviolet radiation; therefore, geographical location and amount of time spent outdoors influence the rate of pterygium.[10,11] This sample population was mainly from the Kimberley region (69.02 per cent, n = 1,430), nearest the equator at 17.34^{0}S, with the remaining patients from the Pilbara (28.14 per cent, n = 583) and Goldfields regions (2.85 per cent, n = 59), with latitudes of 21.59^{0}S and 30.74^{0}S, respectively. This fits within in the so-called 'pterygium belt', located 37^0 north and south of the equator.[2]

The prevalence of pterygium varies greatly between countries: 0.7 per cent in Denmark, 18.4 per cent in Brazil, 23.4 per cent in Barbados and 30.8 per cent in the south-westerly islands of Japan.[12–14] In Australia, the Blue Mountains Eye Study found a rate of 7.3 per cent in those 50 years and older and the Vision Impairment Project reported a rate of 2.8 per cent in those 40 years and older in Victoria.[15,16] Neither study specified rates in Aboriginal individuals. The Blue Mountains Eye Study did note associations with skin, hair and eye colour, showing that participants with darker skin colour and black hair had a higher prevalence of pterygium.

The National Trachoma and Eye Health Program in 1980 found the pterygium prevalence rates in Aboriginal individuals to be three times higher than those of non-Aboriginal individuals (3.4 per cent versus 1.1 per cent).[11] The National Indigenous Eye Health Survey report in 2009 did not note pterygium prevalence.[17] The Central Australian Ocular Health Study (2007) in central rural Australia is the only study since then to examine rates in Aboriginal individuals and found rates of 9.3 per cent in those aged 40 years and older and 10.6 per cent in those aged 50 years and older.[18]

Pterygium prevalence is expected to vary within a country as ethnically diverse and geographically vast as Australia, as has been shown by climatic maps.[11] Moran et al.[11] divided Australia into zones 1–5 according to the levels of ultraviolet radiation: 'Zone 5', nearest the equator, had pterygium prevalence in the Aboriginal population of 13.3 per cent in the 40–59 age group and 15.2 per cent in the 60+ age group. This 'Zone 5' would mirror the current study in geographical region and prevalence of pterygium (14.8 per cent, n = 260) among Aboriginal individuals. The study of Moran et al.[11] established that the rate of pterygium in non-Aboriginal females was half that of non-Aboriginal males.

Worldwide, pterygium is more common in males than females.[15,16,18] More recent Australian studies confirm a higher prevalence in males compared to females: 15 per cent versus 7.7 per cent in the Norfolk Island Eye Study, 11 per cent versus 4.5 per cent in the Blue Mountains Eye Study, and 10 per cent versus four per cent in the Vision Impairment Project.[15,18,19] None of these specified rates in Aboriginal individuals. In 1982, Moran et al.[11] suggested that Aboriginal females had a slightly higher prevalence than males (14.2 per cent in males aged over 60 years, compared to 15.3 per cent in females aged over 60 years); however, this difference was not significant.[11]

The present study demonstrated a higher prevalence of pterygium in Aboriginal females compared to males, whereas the reverse was found in the non-Aboriginal group. In Tibet, females spend more time outdoors than males and studies have found higher rates of pterygium in females.[20] The SunSmart campaign targets sunburn and skin cancer[21] perhaps because these conditions occur much less commonly in Aboriginal individuals, eye protection, particularly for females, is being neglected.

The exact aetiology of pterygium is still unknown, with many proposed associated risk factors: geographical latitude, rural residency, advanced age, male gender and time spent outside.[22] Myopic eyes have been found to have a lower prevalence of pterygium compared to hyperopic eyes.[23] Myopia has been linked to being protective while hyperopia represents an increased risk factor in the development of pterygium.[12,24] Myopia is associated with higher education, indoor occupations and lower exposure to sunlight, whereas hyperopia is more common in people who spent more time outdoors.[4,6,9,25] Low exposure to causative sunlight may be preventative, and further prevention of development may be attributed to spectacles acting as a UV protective barrier. Myopic patients start to wear glasses at a younger age compared with hyperopic patients.[23]

Studies have shown a strong inverse relationship between myopia and conjunctival ultraviolet autofluorescence, an objective biomarker of ocular sun exposure and outdoor time.[4,6,19] Prevalence rates for myopia (≤ −1.00 DS) in the USA, Western Europe and Australia have been estimated to be 25.4 per cent, 26.6 per cent, and 16.4 per cent, respectively.[26] Rates in Asia are consistently higher, ranging from 30 per cent up to 80 per cent in a student population.[9,27,28] Studies from Australia demonstrate lower rates for myopia (≤ −1.00 DS); 10.1 per cent in the Norfolk Islanders and 13 per cent in the Vision Impairment Project, Victoria.[24,29] The Blue Mountains Eye Study and Vision Impairment Project found 15.5 per cent and 17 per cent of respective participants had myopia at the level of < −0.50 DS.[29,30] These Australian studies do not specifically mention refractive data in Aboriginal individuals.

There is a scarcity of published data pertaining to refractive error of Aboriginal individuals. In 1980, Taylor[31] found lower rates of myopia in Aboriginal compared to non-Aboriginal individuals. In a recent study looking at refractive errors among Aboriginal individuals, rates for myopia of < −0.50 DS and < −1.00 DS were 31.15 per cent and 16 per cent, respectively.[32] These rates are higher than rates found in the present study of 8.87 per cent (n = 26) and 5.8 per cent (n = 17) using the same myopic definitions. Comparison of prevalence data between studies is difficult, due to variation in methodology; however, there is an evident global rise in myopia.[33] This shift toward myopia had also appeared among Aboriginal Australians from 1977 to 2000, from a MSE of +0.54 DS $\pm$ 0.81 to an MSE of −0.55 DS $\pm$ 0.88.[34] There have been no further extensive studies of myopia rates in Aboriginal populations in the last 20 years. This is an area potentially worth exploring in light of recent trends.

Limitations of the present analyses include the source being an optometry clinic database, and not a population-based sample. Patients had presented to primary eye-care optometry visits, either of their own volition or on advice from their general practitioner. Furthermore, refractive data were analysed only in those with pterygium. This outlines the refractive errors in a sub-set of the population with pathology that is thought to be less prevalent in myopic individuals. Thus, it is a snapshot of a unique, rurally located, Aboriginal cohort with high UV exposure.

Patients were selected from clinic attendees who were mainly Aboriginal; this therefore is not a true representation of Aboriginal populations or Australian populations. Aboriginal people historically have low rates of myopia, but more robust information, including life-long environmental UV exposure, is needed. Further studies of Aboriginal individuals are warranted to determine prevalence rates of myopia. The more that is known, the better, in light of the epidemic status and our global upward trend in myopia.

Conclusion

This paper analysed data from attendees at the Lions Outback Vision clinic; these were mainly Aboriginal individuals from remote, sun-exposed areas. Studies regarding Aboriginal health are limited; few exist with extensive data, robust follow-up and significant results. A higher prevalence of pterygium in Aboriginal females compared to males (p = 0.002) is demonstrated. Individuals with pterygium had good visual acuity (average 6/6 Snellen) and low rates of myopia. No cases of high myopia were observed. This is interesting in light of the global myopia health problem. Cultural and geographical barriers must be surpassed to explore and understand Aboriginal ocular health. A finding of female pterygium preponderance warrants measures to better protect the eyes of Aboriginal women.

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