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Prevalence of trachomatous trichiasis in Australia: the National Eye Health Survey

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ABSTRACT

Importance: Australia is the only developed country to still have pockets of endemic trachoma. The research provides up-to-date, population-based prevalence data of later complications of trachoma amongst a national sample of Indigenous adults.

Background: To report the prevalence of trachomatous trichiasis (TT) in Indigenous Australians aged 40 years and over.

Design: Population-based cross-sectional study

Participants: A total of 1738 (41% male) Indigenous Australians aged 40 years or older, living among 30 randomly selected Australian sites, stratified by remoteness.

Methods: Anterior segment examination was performed and trachoma grading for the presence of TT and corneal opacification (CO) was conducted using the World Health Organization (WHO) simplified grading system.

Main outcome measure: Prevalence of TT

Results: A total of three (0.17%) participants had TT and there were no confirmed cases of trachomatous CO in the NEHS. All three participants with TT were female and aged 40 years or older. Although they had likely spent their childhoods in more remote

areas, two of the three confirmed cases resided in an urban and outer regional area at the time of their examinations.

Conclusion and relevance: Our data is in line with on-going national trachoma surveillance reports that suggest the prevalence of late sequences of trachoma appear to be decreasing in Australia.

Keywords: trachoma, trichiasis, Indigenous health

INTRODUCTION

Trachoma is caused by a bacterial (*Chlamydia trachomatis*) infection of the conjunctiva[1] and remains the leading infectious cause of blindness worldwide.[2] The disease has two phases, the initial "active stage" inflammatory response is usually seen in children. The late stage with scarring and structural changes in the eyelids causes trichiasis, entropion, corneal scarring and vision loss.[3] Australia is the only developed country to still have pockets of endemic active trachoma (defined as prevalence >5%)[4] and known regional differences in the prevalence of trachoma exist, with rates being highest amongst very remote inland regions of New South Wales, the Northern Territory, South Australia and Western Australia.[3,5]

Supported by the World Health Organization (WHO), the Alliance for the Global Elimination of Blinding Trachoma by 2020 (GET 2020) promotes a four-component strategy to tackle endemic trachoma.[6] Known as the SAFE strategy, this model includes; **S**urgery for trichiasis, **A**ntibiotic treatment, **F**acial cleanliness and **E**nvironmental improvements.[7] Since 2009, Australia has accelerated efforts towards fully implementing this strategy in order to meet the global targets by the year 2020.[9]

The first national trachoma data for Australia came from the National Trachoma and Eye Health Program of the Royal Australian College of Ophthalmologists (NTEHP) in 1980.[10] The overall national prevalence of active trachoma and TT in this program were 17.6% and 6.0%, with the prevalence of TT increasing to 34% in Central Australia.[10] Despite significant improvements over the last 30 years,[11] recent population-based studies have reported the prevalence of active trachoma is still common in children, particularly in very remote areas, and later complications of trachoma are still commonly observed in older Australians.[5,12] The National Indigenous Eye Health Survey (NIEHS) (2008) reported an the overall national prevalence of active trachoma of 3.8%,

with endemic levels found in 50% of very remote communities.[5] These rates are generally similar to reports from screening of Indigenous school children conducted in the Northern Territory, South Australia and Western Australia in 2006 and 2007.[13,14] Furthermore, rates of later complications of trachoma in Indigenous adults aged 40 years and over have been recently documented, with the prevalence of TT in the NIEHS[5] and the Central Australian Ocular Health Study (CAOHS, 2010)[12] reported to be 1.4% and 6.1%, respectively. While both of these studies reported endemic levels of blinding trachoma in many very remote inland Indigenous communities, TT was also observed in coastal and regional areas of Australia in the NIEHS. From this it is clear that despite notable improvements, trachoma remains a major health concern in many Indigenous Australian communities.

The purpose of this study is to report the prevalence of later complications of trachoma amongst Indigenous adults found in a national, population-based sample from the National Eye Health Survey (NEHS).

METHODS

Study population

The NEHS is a population-based survey that took place between March 2015 and April 2016 across thirty geographic areas in five Australian States and one Territory, stratified by remoteness. The sampling methodology of the NEHS has been described in detail elsewhere.[15] In brief, a multi-stage random-cluster sampling methodology was utilised to identify thirty geographic areas across five Australian States and one Territory, stratified by remoteness, to obtain a representative sample of Indigenous Australians aged 40 years and older. In total, 12 major city, 6 inner regional, 6 outer regional, 4

remote and 2 very remote sites were selected, corresponding to the approximate distribution of populations within each remoteness area.

Ethics approval was obtained from; the Royal Victorian Eye and Ear Hospital (RVEEH) Human Research Ethics Committee (HREC-14/1199H), the Aboriginal Health and Medical Research Council (AH&MRC) of New South Wales (HREC-1079/15), the Menzies School of Health Research (HREC-2015-2360), the Aboriginal Health Council of Western Australia (AHCWA) (HREC-622) and the Aboriginal Health Council of South Australia (AHCSA) (HREC-04-15-604). Study procedures adhered to the tenets of the Declaration of Helsinki.

Examination procedures

Testing venues included culturally appropriate facilities that were easily accessed by community members including; community centres, schools, Aboriginal corporations, function centres, land councils, medical clinics, mobile clinics and town halls. All participants provided written informed consent. Information on participant demographics (date of birth, gender, level of education, country of birth, main language spoken at home), general health (e.g. diabetes and stroke), past ocular history and health service utilisation were obtained via self-report using an interviewer-administered questionnaire. Participants who identified as Indigenous were further classified into one of three categories that included; 1) Aboriginal, 2) Torres Strait Islander or 3) Aboriginal and Torres Strait Islander.

All ocular examinations were administered by ophthalmologists, optometrists, orthoptists or research assistants who were thoroughly trained under a standardised training protocol in all procedures and were under the supervision of an orthoptist or optometrist. Presenting distance visual acuity (VA) was assessed using a logMAR chart (Brien Holden Vision Institute, Australia) at 3 m in a well-lit room. Automated refraction was performed (Nidek Co., LTD, Japan) on participants whose VA improved to ≥6/12

with pinhole in one or both eyes. Anterior segment assessment was conducted using a Keeler PSL hand-held slit lamp (Keeler Ophthalmic Instruments, UK) at 10x magnification. Participants with presenting distance VA of <6/12 in one or both eyes had anterior segment photographs taken using a non-mydriatic Diabetic Retinopathy Screening (DRS) camera (CenterVue SpA, Italy). Vision impairment and blindness were defined as having presenting visual acuity of <6/12-6/60 and <6/60, respectively. Trachoma grading for the presence of trachoma trichiasis (TT) and corneal opacification (CO) was conducted using the WHO simplified grading system.[16] In brief, TT was defined as the presence of one or more upper lid lashes touching the cornea, while CO was defined as the presence of a central corneal stromal opacity associated with other features of cicatricial trachoma.[16] In this study, all participants underwent a slit-lamp assessment for the clinical signs of trachoma. Anterior segment photographs of participants with suspected trachoma were graded independently and in a masked manner by two ophthalmologists. In cases where anterior segment photo documentation was not available, the clinical grade as determined by the study optometrist was used.

Data analysis

All data was entered into a specialised online cloud-based database using tablet computers. The database was password protected, and each individual was allocated a unique identification code to maintain confidentiality. Following the collection of data for each participant, a checklist was completed by the examiner to ensure that all data were complete and valid. Participant demographic characteristics were summarised as the mean and standard deviation (SD) for normally distributed continuous data, and counts and percentages for categorical data.

RESULTS

A total of 2240 Indigenous residents were identified as eligible and 2,035 (90.8%) agreed to participate. Of these, 1738 (77.6%) Indigenous Australian adults (714 males and 1024 females) aged 40 to 92 years (mean age ± standard deviation = 55.0 ± 9.97 years) were examined as part of the NEHS. Reasons for declining participation included; not interested (n = 34, 16.6%), no free time (n = 16, 7.8%), previous bad research experience (n = 1, 0.5%), a recent eye examination (n = 28, 13.6%), refused to answer (n = 89, 43.4%) and other (n = 37, 18.0%). Compared to Indigenous male participants, Indigenous females had a significantly higher prevalence of self-reported diabetes (39.4% vs. 33.9%, p = 0.02) and a higher mean years of educational attainment (mean [SD] = 11.2 [3.4] years vs. 10.7 [3.2], p = ≤0.001) (Table 1).

In total, 10 participants were suspected to have had sequelae of trachoma following clinical assessment by trained survey staff. Of these, anterior segment images were available for 7 of the 10 participants and 3 (0.17%) participants were documented to have TT via trachoma photograding. This may represent a rate in the total Indigenous population aged 40 years and over of 0.03%. Of the 3 participants without anterior segment images, none had vision impairment or blindness and none were considered to have trachoma after further review of their medical and ocular histories. There were no confirmed cases of trachomatous CO.

All three participants with TT were female aged 40 years or older, with 1 residing in an urban region, 1 in an outer regional area and 1 in a remote area at the time of their examinations. The first case was an 83 year old Indigenous female, who had a history of stroke and diabetes (duration = 63 years). Past ocular history revealed previous cataract surgery in both eyes with post-operative aphakia. Presenting visual acuity was 6/60 in each eye, with no significant improvement with pinhole. Grading of retinal images (two-field, 45 degree) revealed scattered dot hemorrhages of the right fundus

and mild non-proliferative diabetic retinopathy and diabetic macular oedema of the left fundus. She had evidence of TT in the right upper lid and senile entropion of the left lower lid with pannus in each eye. These findings were confirmed on anterior segment photos.

The second case was 40 year old Indigenous female who resided in an urban area. General health and past ocular history notes revealed self-reported diabetes (duration = 15 years), trachoma and trichiasis surgery in both eyes 15 years ago. Presenting distance VA was 6/12pt in the right eye and 6/15 in the left eye, with no improvement in ether eye with pinhole. The fundus of each eye was unremarkable on retinal photography grading. She had TT in the upper lids of both eyes and pannus in each eye, which were again confirmed on anterior segment photos.

The third case was a 48 year old Indigenous female residing in a remote area. Her general health, past ocular history and retinal grading results were unremarkable. Presenting distance VA was 6/15 in the right eye and 6/12 in the left eye, with no improvement within either eye. There was TT in the right upper lid with pannus in the right eye, which was confirmed in anterior segment photos.

DISCUSSION

In this study we report the prevalence of trachomatous trichiasis amongst Indigenous adults in the NEHS. Of all Indigenous participants aged 40 years and older, only 0.17% (3/1738) had TT and none suffered CO. This may represent a rate in the total population aged 40 years and over of 0.03%.

Although trachoma is now confined to remote and very remote Indigenous communities,[3] two of the three participants with TT in the present study were tested in major city and regional areas. This finding is similar to the NIEHS that reported cases of

TT in coastal and regional areas of Australia.[5] Presumably, these participants will have spent their some of their childhood in remote or very remote endemic areas. Additionally, all participants with TT in the current study were females. This is not consistent with most previous studies conducted in Australia but correlates with findings in other endemic countries[17] where TT and CO were approximately twice as common among women. One proposed reason for this gender predisposition relates to the traditional role of women in child raising, with a constant proximity to children resulting in an increased risk of repeated *C. trachomatis* infections.[18] Despite this, due to the disproportionately higher number of females in our sample, this finding may simply be a reflection of the over-representation of females in the NEHS.

TT was confirmed in three cases and each had vision loss. The presence of bilateral aphakia was attributed as the main cause of vision loss in one case. In the absence of any significant fundus pathology or improvements on pinhole testing, TT was suspected as a possible cause of vision loss in the remaining two cases. It should be noted, however, that we could not determine unequivocally that trachoma was the sole cause of vision loss in these cases.

The results of the current study can be readily compared to that of the NIEHS[5] due to the employment of comparable methodologies and the similar examination rates achieved (NEHS = 78% vs. NIEHS = 79%). The NIEHS reported TT amongst 1.4% of Indigenous adults aged 40 years and older. This is similar to the National Trachoma Surveillance Program and Reporting Unit (NTSRU) (2013) which reported TT among 1% of participants across 183 at-risk communities in the Northern Territory, South Australia, Western Australia and New South Wales.[11] The finding of a lower trachoma prevalence in the NEHS may indicate that initiatives targeting trachoma,[19] coupled with clear improvements in housing water and sanitation, have had some success in lowering the overall prevalence of late complications of trachoma in Australia. Although

the present study employed a similar sampling methodology to the NIEHS (random cluster, stratified by remoteness), vast differences in the regions of Australia that were sampled mean that these comparisons must be viewed with caution.

The prevalence of TT in the present study is substantially lower than that reported in a similarly aged cohort in the CAOHS (6.1%).[12] This finding is likely to be explained by differences in areas sampled and the recruitment strategies between the two studies. That is, the CAOHS examined Indigenous individuals who attended an eye clinic held in remote and very remote inland areas where the prevalence of trachoma is highest.[20] Strengths of the NEHS include the national scope, high response rates and the use of a standardised protocol to grade for TT and CO. However, one key limitation must be considered. That is, a limited number of remote and very remote inland sites were sampled in the NEHS. Given Indigenous communities in remote and very remote inland regions of Australia display the highest rates of trachoma, this is likely to have resulted in the low prevalence observed in the present study. Despite this, sampling in the NEHS was random and was designed to determine the national prevalence of all causes of vision impairment and blindness in Australia, rather than regional comparisons of the prevalence of trachoma.

In this national population-based survey, the prevalence of the late sequences of trachoma in Indigenous Australians aged 40 years and over was 0.17%. This is considerably lower than that of previous population-based reports over the past decade, however comparisons are problematic due to differences in the regions sampled.[5,12] While it is clear from on-going national surveillance that pockets of endemic levels of trachoma still exist,[11] our data provides further support that the national prevalence of trachoma appears to be decreasing in Australia.

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TABLE

Table 1: Key demographics of Indigenous participants, stratified by gender

Characteristic	Total (n = 1738)	Male (n = 714)	Female (n = 1024)	p*
Mean age (SD)	55.0 (10.0)	55.1 (9.8)	54.9 (10.1)	0.69
Educational attainment (years, SD)	11.0 (3.3)	10.7 (3.2)	11.2 (3.4)	≤0.001
English spoken at home (n, %)	1671 (96.1%)	685 (95.9)	986 (96.2)	0.82
Self-reported diabetes (n, %)	645 (37.1%)	242 (33.9)	403 (39.4)	0.02
Self-reported stroke (n, %)	152 (8.8%)	72 (10.1)	80 (7.8)	0.13

*p values based on the chi-squared test for categorical variables or two independent samples t-test for continuous variables, comparing characteristics of Indigenous male and female participants. Statistical significance was set as a p value of <0.05 (two-tailed).