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Disparities in access to anti-VEGF treatment for neovascular age-related macular degeneration

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ABSTRACT

Background: Late neovascular age-related macular degeneration (nvAMD) is very common and causes irreversible severe visual loss unless treated swiftly with vascular endothelial growth factor (VEGF) inhibitors. Although publicly subsidized access to treatment may be inequitable, which is why we assessed treatment provision across Australia.

Design: Secondary analysis of Australian data

Participants: All Pharmaceutical Benefits Scheme (incl. Repatriation PBS) beneficiaries

Methods: Treatment and incidence data were obtained from Medicare Australia, the Royal Australian and New Zealand College of Ophthalmologists, Optometry Australia, the Blue Mountains Eye Study, and the Australian Bureau of Statistics. Data were mapped using geographical information software, and factors associated with treatment provision assessed using multiple linear regression models.

Main Outcome Measure: Unmet need (%) for anti-VEGF treatment for nvAMD

Results: On average we estimated 7,316 incident cases of nvAMD not to be treated per year from 2010 to 2014 (50.1% of total). Number of ophthalmologists and optometrists (per 1,000, $\beta=-0.024$; 95% confidence interval (CI) -0.041, -0.007) and being located in remote regions ($\beta=0.186$; 95% CI 0.110, 0.262) were associated with percentage of untreated cases. A higher proportion of the population speaking a language other than English at home was associated in univariate analyses only ($\beta=0.0015$; 95% CI -0.0004, 0.0027; $p=0.007$).

Conclusion: A large proportion of incident nvAMD is not treated with anti-VEGF. Not receiving treatment is more likely in regional or remote areas and areas with fewer service providers. Not speaking English at home may further limit access. Service delivery models for more equitable service provision are needed.

Keywords: anti-VEGF, neovascular age-related macular degeneration, access, Australia.

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INTRODUCTION

Age-related macular degeneration (AMD) is one of the main causes of irreversible visual loss globally and expected to increase due to population ageing.^{1,2} The late stage of the disease can be subdivided into atrophic (or “dry”) and neovascular (or “wet”; nv) AMD. Treatment is only available for the nvAMD stage and subsidized in all high-income countries. Anti-vascular endothelial growth factor (VEGF) treatment for nvAMD requires swift initiation of treatment after disease onset as well as frequent intraocular injections in order to maintain or improve vision.^{2,3} Available drugs are ranibizumab (Lucentis®, approved use), aflibercept (Eylea®, approved use) or bevacizumab (Avastin®, off-label). In Australia, ranibizumab and aflibercept have been listed on the Pharmaceutical Benefits Scheme (PBS) since August 2007 and December 2012, respectively, allowing subsidized access to the drug for subfoveal nvAMD, which is confirmed on fluorescein angiography (www.pbs.gov.au).

Anti-VEGF treatment outcomes for nvAMD are generally good in routine clinical practice⁴, and maintain or improve vision as well as quality of life.⁵ The annual incidence of blindness caused by nvAMD in Australia was estimated to be reduced by 68-72% with as needed and monthly ranibizumab treatment respectively, using Australian population-based incidence data from the Blue Mountains Eye Study (BMES) and outcomes from clinical trials of ranibizumab.⁶ However, concerns have been raised as to whether all patients with newly developed nvAMD receive anti-VEGF treatment, and a discrepancy between estimated annual incident cases and patients starting new anti-VEGF treatment of up to 5,000 cases/year has been reported.⁷ In the UK, a considerable geographical variation in rates of intraocular injections per person per 100,000 population from 0.9 to 42.2 has been observed, suggesting a geographical variation in availability of treatment and ease of access.⁸

Given the potential of anti-VEGF treatment to avert blindness, it seems paramount that any new case of nvAMD has access to treatment as quickly as possible.³ Against this background, we assessed anti-VEGF treatment provision and need for treatment for nvAMD across Australia.

METHODS

In order to assess anti-VEGF treatment provision, need for treatment, and potential barriers in accessing treatment we used several different datasets. Data were collated at national, state and statistical area 3 (SA 3, encompassing several postcodes) levels across Australia. SA3 is the smallest regional break down provided by Medicare Australia for their data, and was used as it allowed for the most detailed assessment of regional distributions of treatment provision, treatment need as well as associated factors.

Data on treatment provision

We obtained PBS data available through the MEDICARE External Request Evaluation Committee (EREC), which approved the release of data, for the PBS listed drugs ranibizumab and aflibercept. As bevacizumab is only used off-label in ophthalmology, no data on its use are available. Given the availability of ranibizumab and aflibercept through the PBS for subfoveal nvAMD, the vast majority of these cases can be expected to have undergone treatment with these two anti-VEGF agents in Australia. The data requested from Medicare was "filled scripts", justifying the assumption that the amount of ranibizumab or aflibercept prescribed approximated the amount used. Data obtained were based on the location of the patient not the location of the provider.

National Medicare data were obtained for PBS items 1382R (Lucentis) and 2168D (Eylea) between 1 January 2010 and 30 June 2014. Up to the end of 2014, both

ranibizumab and aflibercept had PBS approval only for use in nv AMD. The data included demographic information (year of birth, gender), location for each patient as well as the number of treatments, date of first supply ever and subsequent supply dates as well as quantities per patient.

Data on need for treatment/incidence

The BMES is a population-based longitudinal study of vision and common eye diseases representative of an older Australian community sample in the Blue Mountains region in the state of New South Wales (NSW), the first phase of which was conducted between 1992 and 1994. At the 10-year follow-up incidence of nvAMD was reported as 10-year cumulative incidence.⁹ Using these data in a recent study, an annual incidence of nvAMD qualifying for anti-VEGF treatment as outlined in the PBS approval was calculated using the Australian population aged 60 years or over and assuming an evenly distributed occurrence of events during the BMES observation period.⁶ The proportion of incident nvAMD cases not qualifying for anti-VEGF treatment was assumed to be 27.5% based on previous natural history studies of AMD¹⁰ which we rounded up to 28% in this study. The employed methodology to calculate incident cases of nvAMD was otherwise identical to the aforementioned study.⁶ We used Australian 2011 Census data of persons aged 60 and older as the reference population. Using the Medicare/PBS data provided (see above) and the calculated number of incident cases, the number of incident cases not treated was calculated as the difference *annual incident cases – annual cases starting new treatment*. As different SA3 regions differed considerably in their population we calculated the percentage of cases not treated as $(\text{annual incident cases} - \text{annual cases starting new treatment}) / \text{annual incident cases}$ for every SA3.

Data on availability of treatment

Location of optometry practices was obtained from Optometry Australia. Location of ophthalmologists was obtained by combining a 2010 listing from the Royal Australian and New Zealand College of Ophthalmology (RANZCO), updated by the Macular Disease Foundation Australia (MDFA) in 2014 by contacting practices and sending mailings seeking information on secondary practices. Not all practices responded, and some new practices may not have been identified. However, the majority of ophthalmology practice locations were captured. We considered multiple locations of work for both ophthalmologists and optometrists if they were in separate SA3s, as well as optometrists visiting SA3s as part of the "Visiting Optometrist" service scheme. Workforce data published by the Australian Health Practitioner Regulatory Authority (AHPRA) does not capture multiple practice locations in different SA3s or visiting optometrist schemes which is why it was not used in this study.

Data from the Australian Bureau of Statistics (ABS) were obtained for all SA3s for:

- Remoteness
- Persons in nursing homes.
- Persons speaking a language other than English at home.
- Socio-economic indexes for areas (SEIFA): Index of relative socio-economic advantage and disadvantage (best = 10; worst = 1).

Data analysis

Bivariate and partial correlations were conducted to examine continuous factors independently associated with percentage of untreated incident cases of nvAMD and t-tests were conducted to determine associations with categorical variables. The relationship between percentage of untreated incident cases of nvAMD and the risk factors identified as significant in the univariate analysis was examined using a multivariable linear regression model. A plot of the residuals compared with estimates was examined to determine if the assumptions of linearity and homoscedasticity were met. We used three relevant criteria to evaluate fit of the

linear regression models: R^2_{ADJ} (adjusted), Akaike's information criterion (AIC), and Bayesian information criterion (BIC). Generally, higher variance explained by the model (R^2_{ADJ}) and lower AIC, and BIC values indicate good fit. We used the new Stata program "vselect" to perform variable selection following linear regression. All statistical analyses were conducted with Stata version 13.1.0 (Stata Corp, College Station, TX). A two-tailed p-value <0.05 was considered statistically significant.

We used an advanced license version of ArcGIS 10.3 Software (ESRI Inc., Redlands, CA, USA) for geographical mapping of the data. Prior to mapping, the geographical location data of SA3 areas was cross-linked with equivalent service provider, ABS and Medicare data using Python 2.7 to create categories and map multiple attributes of the data.

RESULTS

Sample Characteristics

A total of 32,739 patients started anti-VEGF treatment between 1 January 2010 and 30 June 2014, receiving a total of 423,864 injections during that period (**Table 1**). The majority were women ($n=19,858$, 60.7%) and the average age was 80.3 years (standard deviation/SD ± 8.4 years). Over half of patients received only ranibizumab ($n=18,677$, 57.0%), whilst 6,049 (18.5%) received only aflibercept, and 8,013 (24.5%) received both. An annual average from 2010 to 2014 was calculated. Based on this, 7,275 patients started new anti-VEGF treatment for nv AMD per year, and received an average of 8 (SD ± 4) injections during their first year of treatment, and an average of 6 (SD ± 4) injections per year for the duration of treatment. Of all the patients who were supplied with treatment, the majority (80.7%) lived in NSW (39.4%), Victoria (21.6%) and Queensland (19.7%), and in these states mostly in major cities (67.3%) with less than 1% of all treated patients living in remote and very remote regions (**Table 1**).

Using BMES and census data, 14,591 incident cases of nv AMD qualifying for anti-VEGF treatment were estimated to occur annually, which leaves an average discrepancy of 7,316 cases not being treated per year (50.1% of the total number of incident cases; **Table 1**). Excluding NT as an exceptional situation due to its remoteness, the largest proportion of untreated cases was in South Australia (61.6% of all incident cases in the state; n=793) and Victoria (57.9%; n=2,165), followed by Western Australia (55.5%; n=727) Queensland (46.2%; n=1,234) and NSW (42.2%; n=2,099). The ACT had the lowest proportions as well as lowest actual number of untreated incident cases (39.1%; n=72). In line with the population distribution in these states, the largest number of untreated incident cases was in major cities (n=5,053, 50.8% of all incident cases in major cities). However, proportions of cases not treated were higher in remote and very remote locations (64.4 and 76% respectively, **Table 1**) but the actual number of cases in remote/very remote locations was small.

The majority of ophthalmologists and optometrists were located in the three most populous states (NSW, Victoria and Queensland), and in these mostly in major cities (84.5% of ophthalmologists and 76.4% of optometrists; **Table 1**). Number of ophthalmologists and optometrists was highly correlated across all SA3s ($r=0.827$; $p<0.001$). Speaking a main language other than English at home was most common in major cities (28% of the population) with the exception of very remote locations where a larger proportion of residents spoke a main language other than English (45%). In all states, between 3-4.8% of the population aged 60+ years lived in nursing homes or homes for the elderly, with most of these located in major cities (**Table 1**). SEIFA indices across the most populous states were similar (5.6-6.1), with Tasmania having the lowest at 3.6 and the Australian Capital Territory the highest (8.8; **Table 1**). SEIFA indices decreased with increasing remoteness, from 7.1 in major cities to 2.8 in very remote locations (**Table 1**). The distribution of the percentage of untreated cases as well as ophthalmologists across Australia has been

mapped in **Figure 1** and highlights the uneven distribution with most service providers located in major cities and most unmet treatment need located in regional and remote Australia.

Factors associated with untreated incident cases of nv AMD

In univariate analyses a higher number of ophthalmologists and optometrists, and a higher SEIFA were associated with a lower proportion of untreated cases across all SA3s (all $p \leq 0.009$, **Table 2**). A higher proportion of the population speaking a language other than English at home as well as being located in outer regional or remote or very remote Australia was associated with a higher proportion of untreated cases (all $p \leq 0.021$, **Table 2**). Interestingly, a higher proportion of the population aged 60+ years was associated with a lower proportion of untreated cases ($p = 0.001$; **Table 2**). In multivariate analyses, the number of ophthalmologists and optometrists (combined due to high correlation; per 1,000), remote/very remote locations and the proportion of the population aged 60+ years remained associated with the proportion of untreated incident cases of nvAMD (**Table 2**).

DISCUSSION

In this study we demonstrated that a large proportion of incident nvAMD is currently not being treated with the anti-VEGF agents ranibizumab or aflibercept. Service providers such as ophthalmologists and optometrists are unevenly distributed, which likely creates an access barrier. These two factors are closely linked in remote regions, but even parts of major cities or inner regional Australia with fewer optometrists and ophthalmologists had a higher proportion of untreated cases. Our findings emphasize the need for more equitable access to anti-VEGF treatment for nvAMD across all regions.

Our results are in line with a recently published PBS review of anti-VEGF drug use for nvAMD in Australia, which reports an annual average of new nvAMD cases starting anti-VEGF treatment of 7,402 over the same period (i.e. 2010 to 2014; 7,275 in our study).¹¹ The only other comparable study conducted in the UK found an up to 50-fold variation in age-standardised anti-VEGF injection rates for nv AMD between different regions in the UK, with differences not being related to socio-economic indices but to the availability of service providers, i.e. ophthalmologists, which is also reflected in our results.⁸ Other Australian studies investigating access to general or specialist healthcare support our findings and report less access in regional and remote Australia, plus socio-economic and language barriers irrespective of location.¹²⁻¹⁴ Studies conducted in Canada, which is similar to Australia in terms of its vastness and uneven spread of its population and medical services, have also reported barriers related to socio-economic status and distance to accessing healthcare.¹⁵ A number of other studies have reported distance to primary healthcare providers to reduce likelihood of utilising preventative as well as acute healthcare services.^{16,17} Our findings highlight that even if distance might not be a barrier, such as in major cities or inner regional Australia, unavailability of service providers and socio-economic as well as language barriers might still prevail. This needs to be addressed in an effort to provide more equitable access to anti-VEGF treatment for nvAMD.

The observed association between an increase in the proportion of the population aged 60+ years and a decrease in the proportion of untreated incident cases of nvAMD is counter-intuitive and contradicts the steep increase in prevalence and incidence observed for nvAMD with age. The main reason for this appears to be the Australian population distribution: 71% of the population live in major cities, where 69% (n=5,051) of untreated incident cases of nvAMD occur, but the population in major cities is younger compared to inner regional Australia (19% of the population

is aged 60+ in major cities compared to 23% in inner regional Australia, $p < 0.001$), where almost all other untreated incident cases of nvAMD occur. Thus, any relationship assessed at a geographical (in this case SA3) level will yield the reported relationship of increasing proportion of untreated incident cases with decreasing age. This association does not discredit the data or the analyses we report and can be fully explained.

To our knowledge the data provided by Medicare are accurate, and we have no reason to suspect a large systematic error by which we would miss almost 50% of treated patients. Similarly, the incidence figures derived from the Blue Mountains Eye Study are valid and similar to other countries, and have been used previously to calculate expected annual incidence of neovascular AMD.⁶ We may have underestimated the number of cases treated as we do not have any data on the use of Avastin. However, this is likely to be a small proportion and should not affect the overall trends observed. This then leads to the question of whether there are reasons which systematically discourage patients from accessing treatment, such as availability, cost (gap fees), the need for ongoing monitoring and treatment, etc., which future studies should urgently assess and address.

Blindness comes with a considerable loss of quality of life, increased morbidity, mortality, higher rates of institutionalisation, and increased personal and societal cost. In 2010, the annual total cost of blindness caused by AMD was estimated to be \$5.15 billion in Australia.¹⁸ Based on our estimates, there may be as many as 7,000 persons with new nv AMD each year who do not access anti-VEGF treatment in Australia. The natural history of nv AMD leads to blindness within a few years. Assuming that at least half of legal blindness can be prevented with anti-VEGF treatment as has been demonstrated for Denmark¹⁹, blindness in up to 3,500 persons a year may be prevented which would halve this economic cost of care but

add the cost of treatment. However, every dollar spent on treatment has been demonstrated to save two dollars in societal benefits in 2010, using the market price of ranibizumab at the time.¹⁸

This study used secondary data provided by Medicare Australia, the Australian Bureau of Statistics, RANZCO and Optometry Australia (to the MDFA) and the Blue Mountains Eye Study (BMES). The BMES is a population-based cohort study, however, the Australian population might have changed since its inception in the early 1990ies. Also, the BMES is a largely Caucasian sample which further limits the extrapolation of results to areas with a different ethnic profile. All datasets were collated and harmonised across SA3s for the whole of Australia. The capture of locations of practice for optometrists and ophthalmologists is likely to be mostly complete except areas which are covered by infrequent outreach services (i.e. "visiting" specialist/optometrists service schemes). Also, locum services or movement across practices is unlikely to be captured. However, no available data source allows to systematically capture this. The BMES data which was collected in the Blue Mountains region only were extrapolated to the rest of Australia. We assume that data on filled ranibizumab or aflibercept scripts equates treatment received. A small number of patients might obtain the medication but chose to not have it administered which is, however, very unlikely. Also, as data on the off label use of bevacizumab (Avastin®) for nvAMD are unavailable, we likely underestimate nvAMD treatment slightly. Given all this, the true extent of the treatment gap might differ from the one reported, but it is very unlikely that it is substantial given our findings which are in agreement to an earlier analysis using a different Medicare dataset.⁷ More remote locations are likely to have a higher proportion of indigenous population for which anecdotal evidence suggests a much lower incidence and prevalence of AMD. Thus the estimated incidence might be an overestimate for some very remote locations and thus we might overestimate the treatment gap.

However, no nvAMD incidence figures are available for indigenous Australians. Due to their overall small number it is unlikely our overall estimates are affected significantly by this. Owing to the overall suboptimal data quality we refrained from any complex statistical testing, and presented data mostly descriptively and with the aid of a mapping tool. Future studies on a population basis are needed to assess the exact extent of the problem and then develop a solution in regards to equitable service provision.

In conclusion, a large proportion of incident cases of nvAMD (potentially up to half) are likely to be missing out on anti-VEGF treatment every year in Australia. Not receiving treatment is more likely in areas which are regional or remote, have a lower socio-economic index and where larger proportions of the population do not speak English at home. As a lack of treatment will lead to a irreversible severe loss of vision, it is a health imperative to enable more equitable access to anti-VEGF treatment for nvAMD and to close the existing treatment gap. Further studies need to establish the exact extent of the problem, assess barriers and then develop service delivery models for equitable anti-VEGF service provision across Australia.

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Table 2. Factors associated with proportion of incident cases of neovascular age-related macular degeneration not treated per year

	Univariate linear regression model		Multivariate linear regression model	
	β (95% CI)	p	β (95% CI)	p
% 60+ in nursing homes	-0.235 (-1.196, 0.725)	0.630	0.747 (-0.190;1.684)	0.118
% speak a main language which is not English at home	0.0015 (-0.0004, 0.0027)	0.007	0.001 (-0.001;0.002)	0.174
Optometrists/1000	-0.028 (-0.048, -0.009)	0.005		
Ophthalmologists/1000	-0.053 (-0.085, -0.021)	0.001		
Optom + Ophthal/1000*			-0.024 (-0.412;-0.007)	0.006
SEIFA	-0.008 (-0.014, -0.002)	0.009	-0.003 (-0.011;0.004)	0.424
% population 60+ years	-0.508 (-0.817, -0.200)	0.001	-0.378 (-0.688;-0.068)	0.017
Remoteness				
major cities	0		0	
inner regional	-0.022 (-0.053, 0.008)	0.155	-0.004 (-0.048;0.040)	0.861
outer regional	0.052 (0.008, 0.096)	0.021	0.038 (-0.011;0.087)	0.131
remote & very remote	0.228 (0.138, 0.320)	<0.001	0.186 (0.110;0.262)	<0.001

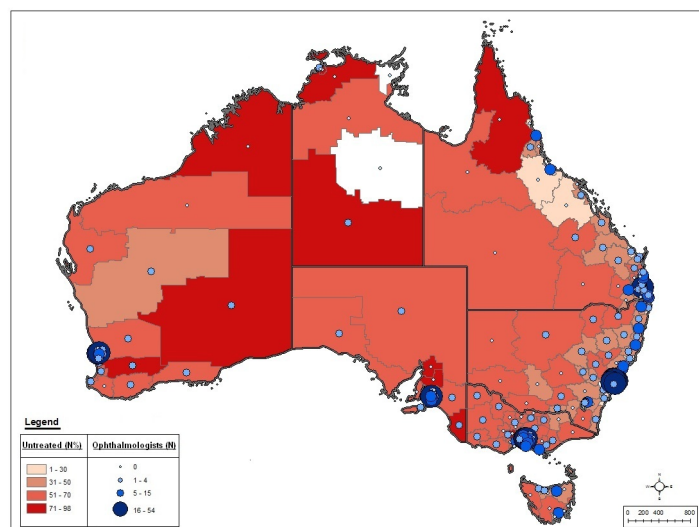
SEIFA= Socio-economic index for areas; β = regression coefficient, a positive value indicates that the variable is associated with an increase in % of untreated cases and a negative value indicates that the variable is associated with a decrease in % of untreated cases. Optom = optometrists; ophthal = ophthalmologists; * combined due to high correlation. Bolded lines indicate statistical significance.

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FIGURE LEGEND

Figure 1: Distribution of percentage of untreated incident cases of neovascular AMD per year and ophthalmologists across Australia. Thickened black borders indicate state borders. White areas indicate zero permanent population.

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Table 1. Characteristics of the datasets for Australia, and by state and remoteness classification

	State										ABS ¹ Remoteness Region					p*
	Australia	NSW	VIC	QLD	SA	WA	TAS	ACT	NT	p*	Major cities	Inner regional	Outer regional	Remote	Very remote	
Population 60 years+, 2011 census (n, % of total population)	4,218,410 (19.6)	1,408,856 (20.4)	1,055,391 (19.7)	812,109 (18.7)	355,149 (22.2)	395,410 (17.7)	113,438 (22.9)	56,535 (15.8)	21,222 (10.0)		2,809,932 (18.5)	948,691 (23.6)	403,476 (21.4)	36,804 (12.8)	10,225 (11.6)	
PBS ² and BMES ³ data – Annual incident cases																
Treated new cases per year (n, % of total)	7,275 (100.0)	2,870 (39.4)	1,573 (21.6)	1,435 (19.7)	494 (6.8)	584 (8.0)	196 (2.7)	112 (1.5)	11 (0.2)	<0.001	4,899 (67.3)	1,699 (23.4)	634 (8.7)	37 (0.5)	6 (0.1)	<0.001
Expected incident cases per year (n, % of total)	14,591 (100.0)	4,969 (34.1)	3,738 (25.6)	2,669 (18.3)	1,287 (8.8)	1,311 (9.0)	383 (2.6)	184 (1.3)	50 (0.3)	<0.001	9,952 (68.2)	3,206 (22.0)	1,304 (8.9)	104 (0.7)	25 (0.2)	<0.001
Incident cases not treated per year (n, % of expected incident cases)	7,316 (50.1)	2,099 (42.2)	2,165 (57.9)	1,234 (46.2)	793 (61.6)	727 (55.5)	187 (48.8)	72 (39.1)	39 (78.0)	<0.001	5,053 (50.8)	1,507 (47.0)	670 (51.4)	67 (64.4)	19 (76.0)	<0.001
PBS ² data for whole sample																
Age at first approval (mean ± SD)	80.3 (8.4)	80.4 (8.4)	81.0 (8.1)	79.3 (8.6)	81.2 (8.0)	80.2 (8.5)	80.5 (8.2)	80.1 (8.5)	76.6 (7.4)	<0.001	80.6 (8.4)	80.2 (8.2)	79.2 (8.2)	78.2 (8.0)	80.9 (8.7)	<0.001
Gender (Male) (n, %)	12,881 (39.3)	5,110 (39.6)	2,746 (38.8)	2,596 (40.2)	864 (38.8)	1,040 (39.6)	320 (36.2)	187 (37.2)	18 (36.0)	.300	8,623 (39.1)	2,996 (39.2)	1,188 (41.6)	57 (33.9)	17 (63.0)	.004
Total number of injections (n, % of total)	423,864 (100.0)	188,677 (44.5)	73,738 (17.4)	78,498 (18.5)	29,596 (7.0)	33,843 (8.0)	12,854 (3.0)	6,214 (1.5)	444 (0.1)	<0.001	289,469 (68.3)	97,681 (23.0)	34,114 (8.0)	2,252 (0.5)	348 (0.1)	<0.001
Total injections per patient (mean ± SD)	14.0 (12.5)	15.6 (13.5)	11.6 (11.0)	13.0 (11.5)	14.1 (12.8)	14.2 (11.6)	16.1 (12.4)	13.1 (12.3)	9.3 (6.7)	<0.001	14.1 (12.6)	13.9 (12.3)	12.9 (11.4)	14.5 (13.0)	16.1 (15.7)	<0.001
ABS ¹ and other data																
Ophthalmologists ⁺ (n, % of total)	1,130 (100.0)	463 (41.0)	280 (24.8)	173 (15.3)	84 (7.4)	91 (8.1)	24 (2.1)	13 (1.2)	2 (0.2)	.025	955 (84.5)	133 (11.8)	35 (3.1)	7 (0.6)	0 (0.0)	<0.001
Optometrists (n, % of total)	3,824 (100.0)	1,283 (33.6)	1,054 (27.6)	691 (18.1)	245 (6.4)	329 (8.6)	133 (3.5)	63 (1.6)	26 (0.7)	<0.001	2,920 (76.4)	641 (16.8)	237 (6.2)	21 (0.5)	5 (0.1)	<0.001
Main language other than English (n, % of total Australian population)	4,982,228 (23.2)	1,899,983 (27.5)	1,476,079 (27.6)	653,883 (15.1)	292,661 (18.4)	461,152 (20.7)	41,001 (8.3)	79,020 (22.2)	78,449 (37.4)	<0.001	4,303,295 (28.3)	345,932 (8.6)	225,274 (12.0)	69,049 (24.0)	38,678 (45.2)	<0.001
Persons in nursing homes (n, % of population aged 60+ years)	179,689 (4.3)	60,751 (4.3)	48,222 (4.6)	31,740 (3.9)	17,159 (4.8)	14,701 (3.7)	4,580 (4.0)	1,920 (3.4)	616 (3.0)	<0.001	125,780 (4.5)	37,870 (4.0)	14,541 (3.6)	1,212 (3.3)	286 (2.9)	<0.001
SEIFA decile index (1 = most disadvantaged, 10 = most advantaged)	5.8	5.6	6.1	5.9	5.3	6.7	3.6	8.8	4.8	<0.001	7.1	4.5	4.0	3.9	2.8	<0.001

[†]Ophthalmologists were counted multiple times if the location of their different places of practice was in different statistical area 3 locations; * Significance testing using either ANOVA or Kruskal-Wallis tests. ¹ Australian Bureau of Statistics. ² Pharmaceutical Benefits Scheme. ³ Blue Mountains Eye Study.

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