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ORIGINAL ARTICLE

Visual field testing and glaucoma drug prescribing patterns in Australia

Catherine L. Jan[1,2,3] | **Algis Vingrys**[1,2,4] | **Randall S. Stafford**[5] | **Mengtian Kang**[6] | **Xianwen Shang**[1,2] | **Wenyi Hu**[1,2] | **Jiahao Liu**[1,2] | **Sanil Joseph**[1,2] | **Mingguang He**[1,2,7,8,9]

[1]Centre for Eye Research Australia, Royal Victorian Eye and Ear Hospital, East Melbourne, Victoria, Australia

[2]Ophthalmology, Department of Surgery, Faculty of Medicine, Dentistry & Health Sciences, University of Melbourne, Melbourne, Victoria, Australia

[3]Lost Child's Vision Project, Sydney, New South Wales, Australia

[4]Department of Optometry and Vision Sciences, The University of Melbourne, Melbourne, Victoria, Australia

[5]Stanford Prevention Research Center, Stanford University School of Medicine, Stanford, California, USA

[6]Beijing Tongren Eye Centre, Beijing Tongren Hospital, Beijing Key Laboratory of Ophthalmology and Visual Sciences, Capital Medical University, Beijing, China

[7]School of Optometry, The Hong Kong Polytechnic University, Kowloon, Hong Kong

[8]Research Centre for SHARP Vision (RCSV), The Hong Kong Polytechnic University, Kowloon, Hong Kong

[9]Centre for Eye and Vision Research (CEVR), Kowloon, Hong Kong

Correspondence
Catherine L. Jan, Centre for Eye Research Australia, Royal Victorian Eye and Ear Hospital, Level 10, 200 Victoria Parade, East Melbourne, Victoria, Australia.
Email: catherine.jan@student.unimelb.edu.au

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Abstract

Purpose: To examine glaucoma practice patterns in Australia, focusing on visual field test uptake and antiglaucoma drug prescribing by optometrists and ophthalmologists.

Design: A serial cross-sectional study was conducted to describe visual field testing charges and compare them to changes in comprehensive eye examination charges, as well as to analyse Pharmaceutical Benefits Scheme (PBS) items for antiglaucoma prescriptions.

Methods: The study utilised Medicare Benefits Schedule (MBS) reimbursements for visual field testing from January 2003 to December 2022, along with PBS prescriptions for antiglaucoma drugs by optometrists and ophthalmologists from January 2008 to December 2022.

Results: From 2003 to 2022, rates of visual field testing per 100,000 population in Australia showed a consistent increase, except for a decline in 2020 due to COVID-19 lockdowns, particularly in Victoria. Optometry surpassed ophthalmology in conducting visual field tests in 2009. Prescription rates for antiglaucoma medications rose significantly from 2009 to 2022, following their inclusion in the optometric PBS, with prostaglandin analogues being the most prescribed. During the 2020 lockdowns, visual field testing decreased while antiglaucoma prescriptions remained stable.

Conclusions: The increase in visual field testing and antiglaucoma drug prescriptions underscores the expanding role of optometrists in glaucoma management in Australia. This rise has not impacted ophthalmology prescriptions, suggesting that the growing scope of optometric practice effectively reaches a broader patient population, especially amid the public health crisis of undiagnosed glaucoma.

KEYWORDS
Australia, glaucoma care, ophthalmology, optometry, perimetry, visual field testing

INTRODUCTION

Glaucoma is the leading cause of irreversible blindness both in Australia and worldwide.[1–4] Despite its significant impact on public health, over half of glaucoma cases remain undetected globally and in Australia,[5,6] highlighting the huge need for effective screening and management strategies. In Australia, optometrists (primary care) and ophthalmologists (tertiary care) are responsible for providing glaucoma care. Understanding glaucoma practice patterns of optometrists and ophthalmologists is not only important for glaucoma management at the individual level but also crucial for developing strategies to reduce glaucoma disease burden in Australia.

Australia's healthcare framework is established on the tenets of universal healthcare and a resilient public insurance scheme (Medicare), guaranteeing free and high-quality medical services for citizens and eligible residents (see study setting for details), ensuring their access to quality healthcare services.[7] Although optometrists can (and some do) charge more than the bulk-billed fee, according to the Federal Government's quarterly Medicare statistics (September quarter 2022–2023), 94.3% of optometry services were bulk billed in the quarter.[8,9] Therefore, analysing the Medicare statistics provides an accurate representation of optometry practice patterns. This framework also ensures free services for the detection of glaucoma.

Glaucoma is a complex disease that requires a complicated diagnostic procedure. Visual field testing (also called Standard Achromatic Perimetry, or computerised perimetry by Medicare) plays a crucial role in the early detection and management of various eye diseases, including glaucoma, making it an essential component of comprehensive eye care.[10] Despite its importance, a significant number of eye diseases, including over half of glaucoma cases, remain undetected,[5,6] leading to potential vision loss and decreased quality of life for affected individuals. One of the key challenges is that people with visual field loss often remain unaware of their reduced vision until the disease progresses significantly.[11,12] To address this issue and ensure timely detection and treatment of eye diseases, visual field testing has been widely advocated as an important screening and diagnostic tool.[13] By assessing a person's visual sensitivity, visual field tests can identify early signs of visual field loss associated with conditions such as glaucoma, optic nerve damage, stroke and retinal disorders.[13] Detecting these diseases in their early stages enables timely interventions and significantly improves the long-term prognosis for patients. Given the importance of visual field testing, it is useful to understand the current uptake and utilisation of this tool in clinical practice.

Furthermore, optometrists in Australia are trained to prescribe antiglaucoma drugs. In 2009, the corticosteroid fluorometholone and a group of antiglaucoma drugs were included on the optometric Pharmaceutical Benefits Scheme (PBS). Surgical interventions in glaucoma treatment require referral to an ophthalmologist specialising in glaucoma (glaucoma specialist). Nevertheless, understanding prescribing trends and patterns in both optometry and ophthalmology will shed light on how glaucoma is being managed.

Key points

- This study provides a national overview of visual field testing and antiglaucoma drug prescribing trends by optometrists in Australia using comprehensive Medicare data from 2003 to 2022.
- The inclusion of antiglaucoma drugs in the optometric Pharmaceutical Benefits Scheme coincided with a marked rise in visual field testing and prescribing activity by optometrists.
- Despite increased optometric-led glaucoma services, ophthalmology volumes were unaffected, suggesting a complementary role and unmet demand for glaucoma care in the broader population.

The primary aim of this research is to characterise trends in Australian visual field test uptake for eyecare from January 2003 to December 2022, and antiglaucoma drug prescribing patterns between January 2008 and December 2022. We systematically describe the use of visual field testing charges made by optometrists and compare these to changes in comprehensive eye examination charges and ophthalmology charges; we also compare the rate of visual field tests before and after glaucoma pharmaceutical privileges were obtained in 2009 and further analyse the PBS items for prescriptions for antiglaucoma medications by optometrists and ophthalmologists.

METHODS

Study setting and data

This study makes use of the nationwide Medicare Benefits Schedule (MBS) statistics available on the Services Australia websites.[14,15] The uptake of the MBS items of interest is reported on a state basis of health providers who rendered the services. Medicare is Australia's universal healthcare system which covers all Australian citizens, Australian permanent residents, New Zealand citizens, temporary residents covered by a ministerial order and citizens and permanent residents of Norfolk Island, Cocos Islands, Christmas Island or Lord Howe Island.[16] Australia's universal healthcare system also entitles all citizens and eligible residents to subsidised prescription medicines through the PBS.

In 2020, there were 6043 optometrists registered in Australia, including 5487 with general registration, 173 with non-practising registration, 22 with postgraduate

training or supervised practice registration and one with teaching or research registration. Among them, 3801 or 65% have scheduled medicines endorsement.[17] Before 2014, antiglaucoma drugs required shared care plans between general medical practitioners (GPs), ophthalmologists and optometrists that aligned with Optometry Board of Australia guidelines. Following the 2014 issuing of revised Guidelines for Use of Scheduled Medicines, PBS shared-care requirements for glaucoma prescriptions were removed.

Optometrists were awarded an MBS item for visual field evaluation in November 2003, with 2004 being the first full calendar year of access to this item. The current evaluation also analyses the geographical breakdown of MBS statistics, exploring how the uptake of visual field testing may have changed since 2004. This study will explore the trends in visual field testing rates over time and delineate uptake based on various temporal and demographic characteristics.

Eligibility and inclusion criteria

Statistics were returned for all optometry Medicare items and ophthalmology visual field claims from January 2003 to December 2022. Visual field testing that was done privately without bulk billing will not appear here. Antiglaucoma drug PBS prescriptions between January 2008 and December 2022 by optometrists and ophthalmologists were also collected and analysed. Two different time periods were used because optometrists were awarded an MBS item for visual field evaluation in November 2003, while antiglaucoma drugs became included on the optometric PBS in 2009.

Outcomes

1. Rate of unilateral and bilateral visual field testing by optometrists as a percentage of comprehensive eye examinations by optometrists in all Australian states between January 2003 and December 2022.
2. Rate of visual field tests per 100,000 population claimed by optometrists versus those by ophthalmologists.
3. Antiglaucoma prescription patterns, including the total of all antiglaucoma drug groups by PBS prescription count by optometrists and ophthalmologists and the percentage of a specific drug group out of all PBS antiglaucoma prescriptions written by optometrists and ophthalmologists.

Statistical methods

Descriptive statistics and mapping were determined for the numbers of claims or claim rate per 100,000 population of MBS items for comprehensive eye examinations, optometry visual field testing (see Table 1 for explanation of each code) and ophthalmology visual field testing (see Table 1 for explanation of each code). Additionally, descriptive statistics were determined for PBS items for optometric prescriptions for glaucoma medications (see Table 1 for codes) and ophthalmology prescriptions for glaucoma medications (see Table 1 for codes). All statistical analyses were performed using Microsoft Excel (2023 Edition, microsoft.com/en-au/microsoft-365/excel) for the initial data organisation and basic calculations. Prism GraphPad Software (Prism 10, graphpad.com/) was used for advanced statistical analysis and graphical presentation.

Research ethics approval

As this study analysed publicly available data, a waiver of ethics application was obtained from the Centre for Eye Research Australia, The University of Melbourne.

RESULTS

There has been a consistent upward trend in the provision and number of claims for comprehensive eye examinations by optometrists per 100,000 population in all Australian states between January 2003 and December 2022, with one exception (Figure S1). There was a notable reduction in claims in 2020, most likely attributed to the COVID-19 lockdowns that restricted free movement, with the state of Victoria being affected the most. The coverage of comprehensive eye examinations was significantly lower in the Northern Territory (NT) compared to the other states. As an average over 18 years (from 2004 to 2022) comprehensive eye examinations per 100,000 population have increased by 66%. South Australia (SA) experienced the most rapid growth (79%) whereas Tasmania (TAS) exhibited the slowest growth (51%).

The rates of unilateral and bilateral visual field testing per 100,000 population demonstrated a consistent upward trend across all Australian states between January 2003 and December 2022 (Figure S2). As an average over 18 years (from 2004 to 2022), the rates of visual field testing per 100,000 population have increased by 240%. Among the states between the years 2004 and 2022, SA witnessed the most substantial increases—403%, whereas the NT has experienced the slowest growth—207% (Figure S2). The year 2003 was not included in this calculation as it was the first year where Medicare items for visual field testing by optometrists had been approved and represented an outlier and low value on the graph.

Rates of unilateral and bilateral visual field testing as a percentage of comprehensive eye examination incidence also increased in Australia between January 2004 and December 2022 (Figure 1). Between 2004 and 2022, SA saw the most rapid growth (184%) whereas TAS grew the slowest (55%) (Figure S2).

TABLE 1 Medicare benefits schedule (MBS) item numbers for comprehensive examinations and visual field testing prescribed by optometrists and ophthalmologists and pharmaceutical benefits scheme (PBS) item numbers for glaucoma medications prescribed by optometrists and ophthalmologists.

	Description
MBS item number by optometrist	
10900	Comprehensive initial consultation
10907	Comprehensive initial consultation by another practitioner
10910	Comprehensive initial consultation—patient is less than 64 years of age
10911	Comprehensive initial consultation—patient is at least 65 years of age
10912	Other comprehensive consultations
10914	Professional attendance for a patient who has a progressive disorder (excluding presbyopia) requiring comprehensive reassessment
10915	Professional attendance with the instillation of a mydriatic, of a patient with diabetes mellitus requiring comprehensive reassessment
10940	COMPUTERISED PERIMETRY Full quantitative computerised perimetry (automated absolute static threshold), with bilateral assessment and report, indicated by the presence of relevant ocular disease or suspected pathology of the visual pathways or brain
10941	COMPUTERISED PERIMETRY Full quantitative computerised perimetry (automated absolute static threshold) with unilateral assessment and report
MBS item number by ophthalmologist	
11221	Full quantitative computerised perimetry (automated absolute static threshold) performed by or on behalf of a specialist in the practice of his or her specialty, if indicated by the presence of relevant ocular disease or suspected pathology of the visual pathways or brain with assessment and report, bilateral—to a maximum of 3 examinations in any 12 month period
11222	Bilateral full quantitative computerised perimetry repeated within 12 months
11224	Full quantitative computerised perimetry unilateral—to a maximum of 3 examinations (including examinations to which item 11,221 applies) in any 12-month period
11225	Unilateral full quantitative computerised perimetry repeated within 12 months
PBS item number by optometrists	
Fixed-dose combination (FDC)	
5535H	Brimonidine tartrate 0.2% + timolol 0.5% eye drops, 5 mL
10547D	Brinzolamide 1% + brimonidine tartrate 0.2% eye drops, 5 mL
5562R	Brinzolamide 1% + timolol 0.5% eye drops, 5 mL
5542Q	Dorzolamide 2% + timolol 0.5% eye drops, 5 mL
10108B	Bimatoprost 0.03% + timolol 0.5% eye drops, 30 × 0.4 mL unit doses
5558M	Bimatoprost 0.03% + timolol 0.5% eye drops, 3 mL
5553G	Latanoprost 0.005% + timolol 0.5% eye drops, 2.5 mL
5555J	Travoprost 0.004% + timolol 0.5% eye drops, 2.5 mL
Beta-blocker	
5544T	Betaxolol 0.5% eye drops, 5 mL
5546X	Timolol 0.1% eye gel, 5 g
5550D	Timolol 0.5% eye drops, 2.5 mL
5548B	Timolol 0.5% eye drops, 5 mL
5547Y	Timolol Maleate, Eye drops 2.5 mg (base) per mL (0.25%), 5 mL
Prostaglandin analogues	
5551E	Bimatoprost 0.03% eye drops, 3 mL
10053D	Bimatoprost 0.03% eye drops, 30 × 0.4 mL unit doses
5552F	Latanoprost 0.005% eye drops, 2.5 mL
2748P	Tafluprost 0.0015% eye drops, 30 × 0.3 mL unit doses
5554H	Travoprost 0.004% eye drops, 2.5 mL
Cholinergic	
5537K	Pilocarpine hydrochloride 2% eye drops, 15 mL
5536J	Pilocarpine hydrochloride 1% eye drops, 15 mL
5538L	Pilocarpine hydrochloride 4% eye drops, 15 mL
Alpha-2 adrenergic agonist	
5563T	Brimonidine tartrate 0.15% eye drops, 5 mL
5534G	Brimonidine tartrate 0.2% eye drops, 5 mL
Carbonic anhydrase inhibitor (CAI)	
5540N	Brinzolamide 1% eye drops, 5 mL
5541P	Dorzolamide 2% eye drops, 5 mL
PBS item number by ophthalmologists	
Fixed-dose combination (FDC)	
8826M	Brimonidine tartrate 0.2% + timolol 0.5% eye drops, 5 mL
10536M	Brinzolamide 1% + brimonidine tartrate 0.2% eye drops, 5 mL
3438Y	Brinzolamide 1% + timolol 0.5% eye drops, 5 mL
8567X	Dorzolamide 2% + timolol 0.5% eye drops, 5 mL
10107Y	Bimatoprost 0.03% + timolol 0.5% eye drops, 30 × 0.4 mL unit doses
9464D	Bimatoprost 0.03% + timolol 0.5% eye drops, 3 mL
8895E	Latanoprost 0.005% + timolol 0.5% eye drops, 2.5 mL
9057Q	Travoprost 0.004% + timolol 0.5% eye drops, 2.5 mL
Beta-blocker	
2825Q	Betaxolol 0.5% eye drops, 5 mL
8803H	Timolol 0.1% eye gel, 5 g
1926J	Timolol 0.5% eye drops, 2.5 mL
1279H	Timolol 0.5% eye drops, 5 mL
Prostaglandin analogues	
8620Q	Bimatoprost 0.03% eye drops, 3 mL
10046R	Bimatoprost 0.03% eye drops, 30 × 0.4 mL unit doses

(Continues)

(Continues)

TABLE 1 (Continued)

	Description
8243W	Latanoprost 0.005% eye drops, 2.5 mL
2755B	Tafluprost 0.0015% eye drops, 30 × 0.3 mL unit doses
8597L	Travoprost 0.004% eye drops, 2.5 mL
Cholinergic	
2596P	Pilocarpine hydrochloride 2% eye drops, 15 mL
2595N	Pilocarpine hydrochloride 1% eye drops, 15 mL
2598R	Pilocarpine hydrochloride 4% eye drops, 15 mL
Alpha-2 adrenergic agonist	
5298W	Brimonidine tartrate 0.15% eye drops, 5 mL
5534G	Brimonidine tartrate 0.2% eye drops, 5 mL
Carbonic anhydrase inhibitor (CAI)	
8483L	Brinzolamide 1% eye drops, 5 mL
8488R	Dorzolamide 2% eye drops, 5 mL

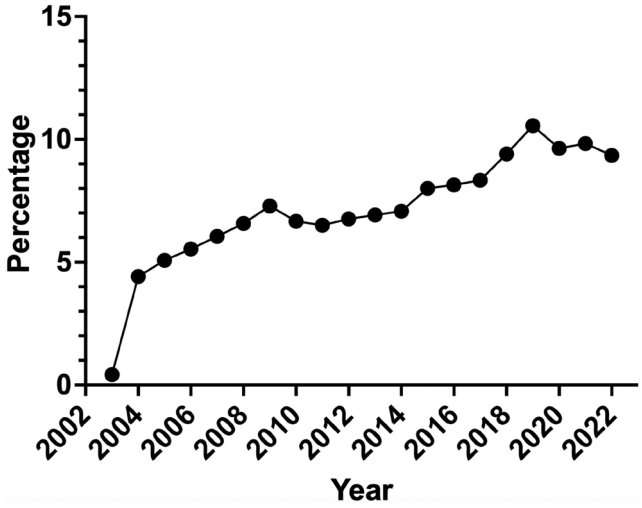

FIGURE 1 Rate of unilateral and bilateral visual field testing by optometrists as a percentage of comprehensive eye examinations by optometrists in all Australian states between January 2003 and December 2022.

In 2022, the highest utilisation of bilateral visual field tests was observed among patients between 45 and 84 years of age, representing a significant portion of the total usage at 73.3% (Figure 2). The age trends from other years were similar to that of 2022 (data not shown). This trend reflects the ageing population in Australia.

The rate of change for visual field test claims in both ophthalmology and optometry settings increased, although the rate of increase was faster for optometry. Visual field charges in optometry settings overtook those in ophthalmology settings in 2009 (Figure 3).

Prostaglandin analogues (PGA) were the most popular antiglaucoma drugs prescribed by optometrists and accounted for 43.7% of all antiglaucoma prescriptions in 2022, followed by fixed-dose combinations (36.5%) and carbonic anhydrase inhibitors (8.5%) (Figure 4a). Similarly, for ophthalmologists, PGA were also the most popular antiglaucoma drugs prescribed up to 2021, when they were overtaken by fixed-dose combinations (Figure 4b). Unlike visual field testing that has decreased during the COVID-19 related lockdowns in 2020, antiglaucoma prescriptions were not seemingly affected (Figure 4a,b).

Figures 4c,d show the percentage of prescriptions for a specific drug group out of all the PBS antiglaucoma prescriptions written that year by optometrists and ophthalmologists, respectively. The optometry prescribing of PGA-related drugs changed over this period, with the percentage of non-combination PGAs decreasing from around 59% in 2009 to 44% in 2022. During the same period, combination drugs prescribed by optometrists have increased from 22% in 2009 to 37% in 2022 (Figure 4c). Similarly, the ophthalmology prescribing of PGA-related drugs changed over this period, with the percentage of non-combination PGA decreasing from around 57% in 2009 to 40% in 2022. During the same period, combination drugs prescribed by ophthalmologists increased from 22% in 2009 to 41% in 2022.

There has been a rapid increase in optometry antiglaucoma medication prescriptions from 2009 to 2022 since antiglaucoma drugs were added to the optometric PBS in 2009 (Table 1). In 2022, 143,661 optometric antiglaucoma items were prescribed, among which latanoprost was by far the commonest prescribed drug (46,700 prescriptions), followed by the combination drug latanoprost + timolol (18,584), brinzolamide (10,762) and the combination drug travoprost + timolol (5887) (Figure 5). Further analysis showed that optometrists wrote approximately 3% of all prescriptions within a specific drug class. Since 2014, 5 years after the PBS approval, the volume of prescriptions written by optometrists has increased by about 20% year on year. Despite the growing therapeutic involvement of optometry, the number of prescriptions written by ophthalmologists has remained largely unaffected.

DISCUSSION

Glaucoma is a multifactorial disease that requires a complex diagnostic procedure including structural and functional assessments as well as family and medical history. Ideally, one should analyse patterns and trends for all glaucoma-related diagnostic tests such as visual field testing, optical coherence tomography (OCT), tonometry, pachymetry and gonioscopy. However, Medicare does not cover all of these items, but rather only covers visual field testing for glaucoma diagnosis and antiglaucoma drugs. Therefore, the aim of this study was limited to characterising visual field testing and glaucoma drug prescribing patterns by optometrists in Australia, using a nationwide database. During this period, there was a significant increase in the provision of visual field testing by optometrists. The volume of tests performed by optometrists exceeded that

of ophthalmologists in 2009. Interestingly, this coincided with the time when antiglaucoma drugs became included on the optometric PBS. In Australia, glaucoma management guidelines are established by national regulatory and professional bodies, including the Australian Health Practitioner Regulation Agency (AHPRA), National Health and Medical Research Council (NHMRC), Optometry Australia (OA) and the Royal Australian and New Zealand College of Ophthalmologists (RANZCO). These guidelines are largely consistent with the United Kingdom's National Institute for Health and Care Excellence (NICE) guidelines,[18] but specifically recognise independent optometric management of glaucoma, provided there is ophthalmological oversight through a review within 4 months to assess the potential need for surgical intervention. According to the updated guidelines,[19] all optometrists—regardless of whether they have therapeutic endorsement for prescribing scheduled medicines—must conduct glaucoma assessments. Optometrists with therapeutic endorsement are authorised to independently diagnose and initiate glaucoma treatment. Once a diagnosis is confirmed and treatment begins, patients should be referred to an ophthalmologist within 4 months.[19] This referral acknowledges that surgical intervention may be a primary treatment option and should be considered in every case.[18,20] Despite the existence of these guidelines, a recent study has shown that only 14% of Australian optometrists opt to initiate glaucoma treatment themselves before referring the patient to an ophthalmologist, 50% preferred initial referral to an ophthalmologist for shared care and 36% referred patients for full management by an ophthalmologist without continuing their own involvement in therapeutic management.[21] In 2022, Latanoprost was the most frequently prescribed pharmaceutical agent by optometrists. This observation implies that a portion of optometrists are actively involved in the diagnosis and management of glaucoma. However, it remains uncertain how many of these prescriptions were attributed to independent optometric management as opposed to collaborative care arrangements, nor does it indicate how many of these were for first-time diagnosis. For future research,

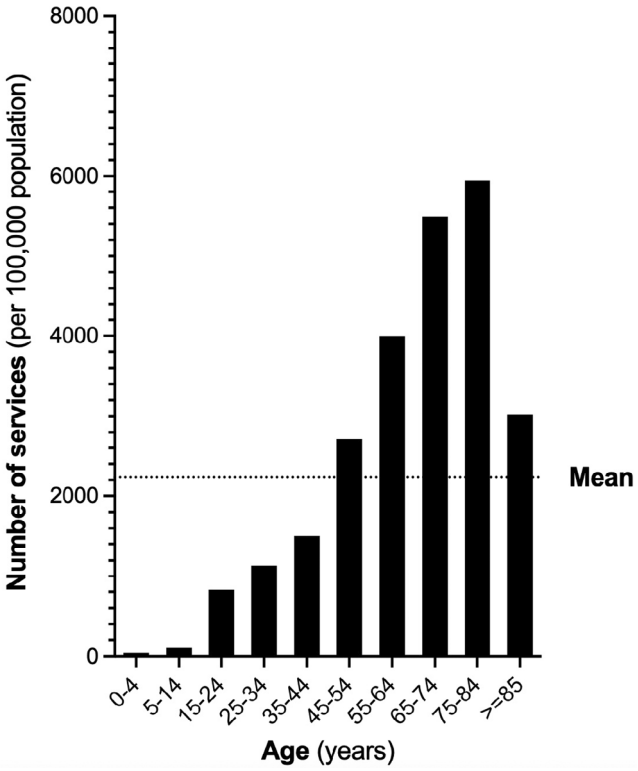

FIGURE 2 Bilateral perimetry by optometrists (Item 10,940) per 100,000 population, stratified by age from January to December 2020.

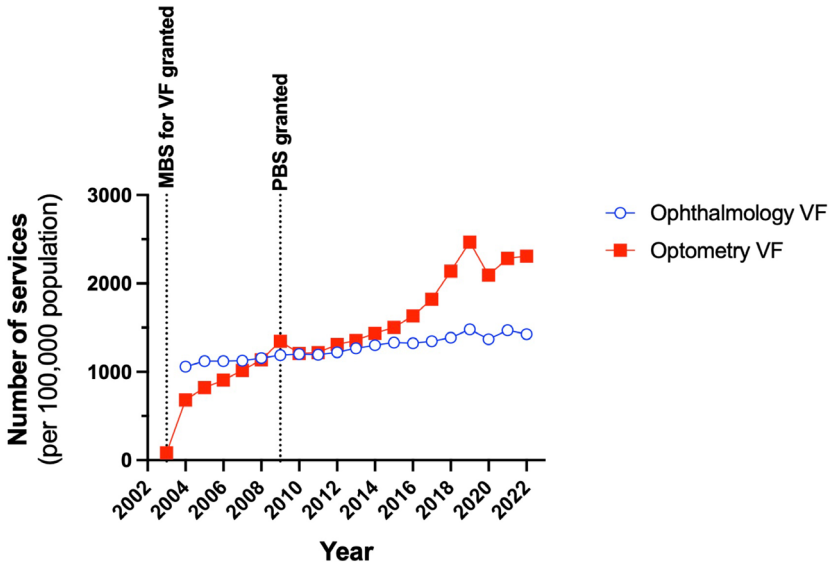

FIGURE 3 Rate of visual field (VF) tests per 100,000 population claimed by optometrists versus those by ophthalmologists. MBS, Medicare Benefits Schedule; PBS, Pharmaceutical Benefits Scheme.

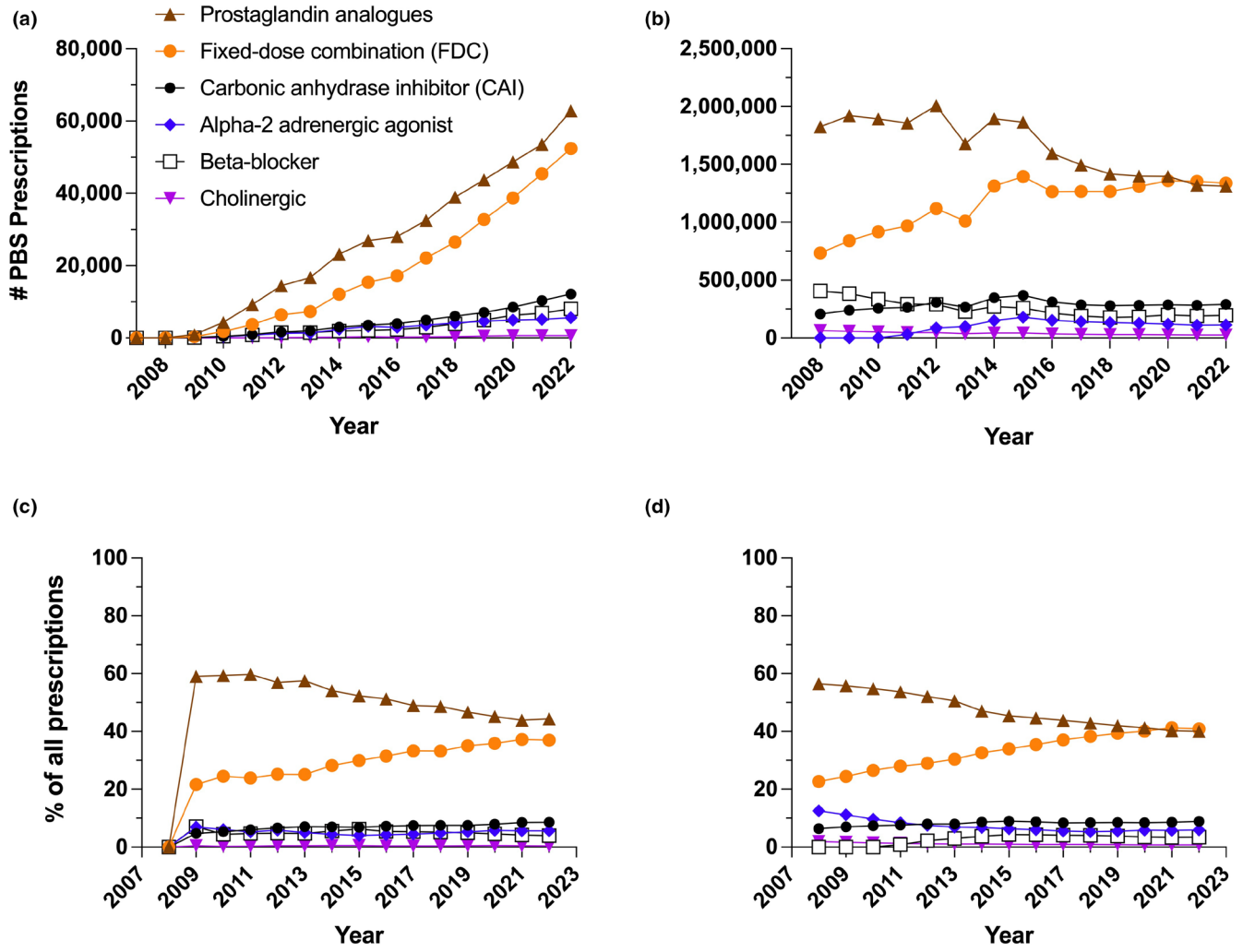

FIGURE 4 Antiglaucoma prescription patterns. (a) Top left. Total of all antiglaucoma drug groups by pharmaceutical benefits scheme (PBS) prescription count by optometrists. (b) Top right. Total of all antiglaucoma drug groups by PBS prescription count by ophthalmologists. (c) Bottom left. Percentage of a specific drug group out of all PBS antiglaucoma prescriptions written by optometrists. (d) Bottom right. Percentage of a specific drug group out of all PBS antiglaucoma prescriptions written by ophthalmologists.

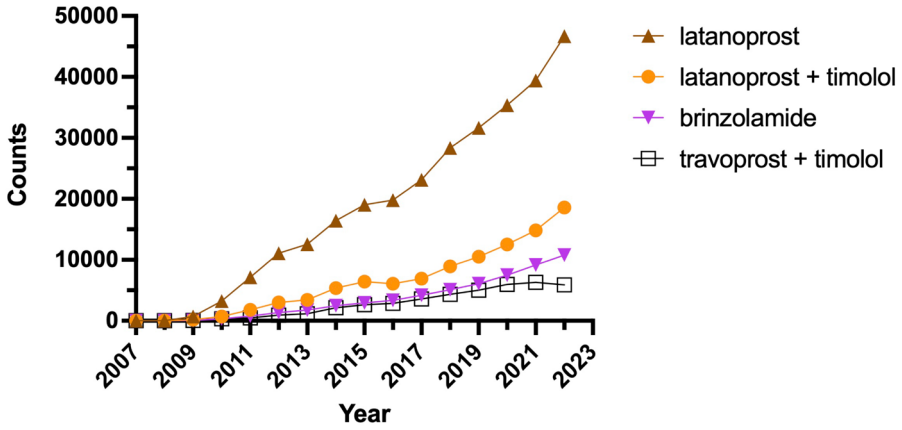

FIGURE 5 Top four antiglaucoma drugs by optometry Pharmaceutical Benefits Scheme (PBS) prescription count.

it would be interesting to compare visual field testing claims with antiglaucoma drug prescriptions by optometrists to establish a causal link.

Contrary to prevailing assumptions, this surge in optometry-driven claims for visual field testing did not impede the utilisation of visual field assessments within

the domain of ophthalmology. On the contrary, it suggests that the burden of visual field testing has been effectively distributed across both fields, with optometrists playing an increasingly important role in glaucoma diagnosis. This shift not only enhances the efficiency of eye health management but also allows ophthalmologists to focus on more complex cases, ultimately reducing the burden on tertiary hospitals and improving patient care. The growing involvement of optometrists underscores the collaborative nature of contemporary eye care, where both disciplines complement each other in optimising patient outcomes.

A recently published retrospective audit[22] spanning from 2003 to 2017 aimed to characterise trends in glaucoma management within Australia's healthcare system. The study focused on Medicare-eligible individuals and analysed MBS item reimbursements and PBS prescriptions. Findings revealed a peak in medication prescriptions in 2015, followed by a subsequent decline. Notably, there was a significant increase in fixed-combination and unpreserved medication prescriptions. Optometrists played a growing role, generating 1.86% of glaucoma prescriptions by 2017.[22] Computerised perimetry reimbursements for optometrists notably surged, surpassing those initiated by ophthalmologists.[22] However, this study did not detail eyecare practice patterns from geographical or age perspectives, nor did it report the effect of introducing optometry prescribing of antiglaucoma drugs on the ophthalmology profession, and there are more recent data to be added as a continuation of this analysis, especially on how the recent trends and patterns have been affected by the COVID-19 pandemic.

Population-based glaucoma screening programmes have not been found to be cost-effective in the Western World based on health economic studies, although some recent evidence suggests they may be cost-effective in China and India.[23–28] Primary eye care practitioners (i.e., optometrists) are therefore best placed to identify new cases of glaucoma. A previous study gave a brief analysis of the glaucoma practice trends and patterns up to the year 2017. They found that the rate of undiagnosed glaucoma in Australia was high (over half of glaucoma cases).[5] There was no direct evidence to support that the increase in visual field assessment by optometrists and ophthalmologists has reduced the rate of undiagnosed glaucoma in the community. However, this is possible, as a study conducted in Victoria, Australia, found that out of 4744 individuals, 72 cases of referable glaucoma were identified, of whom 35 (49%) were undiagnosed.[5] The primary cause of misclassification was the lack of visual field screening, as 97% of the 35 missed cases failed a visual field screening test at a subsequent date.[5] Such evidence argues for more visual field screening of the general population by optometrists. It must be realised that the MBS numbers referred to here do not consider screening tests; they only apply to threshold testing. Further analysis is needed to consider this issue fully.

It should be noted that, at present, there is no MBS item number for optometrists associated with OCT or other tests for glaucoma. Consequently, the extent of glaucoma monitoring by eye care professionals is undervalued if we rely exclusively on visual fields as a diagnostic and management tool. It is imperative to emphasise that visual field testing serves as a diagnostic tool, not only for glaucoma but also for assessing headaches and various neurological conditions. The MBS database does not distinguish whether computerised perimetry was performed specifically for glaucoma or for other indications. Consequently, its utilisation in the evaluation of glaucoma would lead to overestimation of glaucoma surveillance.

The results of the present study also highlight the prevailing trends in the prescription patterns of antiglaucoma drugs by optometrists, shedding light on the pharmaceutical landscape for glaucoma management. PGAs emerge as the dominant class of antiglaucoma medications; however, fixed-dose combinations surpassed these drugs over the period from 2009 to 2022. This finding underscores the widespread preference for PGAs and fixed-dose combinations among optometrists and ophthalmologists in their therapeutic approach to glaucoma.

A noteworthy observation is the resilience of antiglaucoma prescriptions in the face of the challenges posed by the COVID-19-related lockdowns in 2020. Unlike visual field testing (likely due to mask-related difficulties) and comprehensive eye examinations, both of which experienced a decline during this period, the prescription patterns for antiglaucoma drugs remained relatively unaffected (Figures 3–5, Figure S1). This resilience underscores the critical nature of uninterrupted glaucoma management, even during challenging circumstances such as a global pandemic.

Examining the longitudinal trends, the data revealed a substantial increase in antiglaucoma medication prescriptions by optometrists from 2009 to 2022, coinciding with the inclusion of these drugs in the optometric PBS in 2009. These findings provide insights into the specific drugs that dominate the current glaucoma treatment landscape within optometry.

Before therapeutic training courses were introduced to optometrists, concerns had been raised regarding the potential negative impact of optometrists' expanding role in prescribing antiglaucoma medications on public safety and healthcare costs.[29,30] However, the present findings indicate that the uptake in optometry prescriptions has been modest and has not affected ophthalmology prescriptions. In 2020, optometrists prescribed about 4% of all glaucoma drugs. This suggests that existing patients are remaining loyal to their original prescribers or that the majority of prescribing is by way of co-management. The small uptake by optometrists independently suggests that the increasing scope of optometric practice is effectively reaching a broader patient population in need, particularly in the context of the public health crisis related to undiagnosed glaucoma. These findings echo the results of an earlier study

where the overall prevalence of glaucoma medicine treatment remained stable between July 2012 and June 2019.[31] However, the exact cause of these trends needs further directed investigation.

Strengths and limitations

Strengths of this study include the use of detailed quantitative analysis on a large population. The data captured include all of Australia, and therefore is representative of the country. MBS and PBS codes are highly specific and come from a single source, therefore avoiding errors inherent to combining data spread across multiple different coding systems. Limitations must also be acknowledged. First, visual field testing can be carried out for the investigations of conditions other than glaucoma, including retinal disease, migraines, multiple sclerosis, stroke, brain tumours or unknown causes of vision loss. Second, MBS data capture only around 50% of glaucoma care, as it excludes care provided to individuals in the private healthcare system or to those who are ineligible for Medicare.[22] These limitations could not be avoided as there is currently no individual MBS codes for visual field specifically for glaucoma, and there is no available national database for private billings.

CONCLUSION

In sum, the present study provides a comprehensive longitudinal overview of the current landscape of visual field testing and antiglaucoma drug prescriptions by optometrists and ophthalmologists in Australia. The introduction of PBS coverage for antiglaucoma drugs prescribed by optometrists, particularly latanoprost, implied their active involvement in managing glaucoma. Increased optometric services did not reduce the volume of ophthalmological services, and this lack of a substitution effect suggests that there is a large population still in need of glaucoma screening and treatment. Given the efficiency and availability of optometrists relative to ophthalmologists, we would further encourage optometry glaucoma services. This might be possible through continued training of new optometrists who can provide glaucoma care, retraining of optometrists without glaucoma expertise and increased financial incentives for glaucoma tools such as adding a glaucoma screening test (that includes visual field screening, intraocular pressure measurement and optic nerve examination) to the Medicare items list. The absence of an MBS item number for OCT undervalues its use, emphasising the need for financial support for these alternative tools in glaucoma care.

AUTHOR CONTRIBUTIONS

Catherine L. Jan: Conceptualization (lead); data curation (lead); formal analysis (lead); funding acquisition (equal); investigation (lead); methodology (lead); project administration (lead); resources (lead); software (lead); validation (lead); visualization (lead); writing – original draft (lead); writing – review and editing (equal). **Algis Vingrys:** Formal analysis (supporting); methodology (supporting); supervision (equal); validation (supporting); visualization (supporting); writing – review and editing (supporting). **Randall S. Stafford:** Supervision (supporting); writing – review and editing (supporting). **Mengtian Kang:** Writing – review and editing (equal). **Xianwen Shang:** Methodology (supporting); writing – review and editing (supporting). **Wenyi Hu:** Methodology (supporting); writing – review and editing (supporting). **Jiahao Liu:** Writing – review and editing (supporting). **Sanil Joseph:** Writing – review and editing (supporting). **Mingguang He:** Conceptualization (supporting); funding acquisition (equal); methodology (supporting); resources (supporting); supervision (equal); writing – review and editing (supporting).

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CONFLICT OF INTEREST STATEMENT

Professor Mingguang He holds an appointment with Eyetelligence Pty Ltd. (Chief Medical Officer). Professor Algis Vingrys is the founding director of Glance Optical Pty. Ltd. Prof. Randall S. Stafford is a co-founder and co-owner of Data Yakka. Catherine L. Jan has no conflict of interest to declare.

ORCID

Catherine L. Jan https://orcid.org/0000-0001-7383-8208

REFERENCES

1. Dimitrov PN, Mukesh BN, McCarty CA, Taylor HR. Five-year incidence of bilateral cause-specific visual impairment in the Melbourne visual impairment project. *Invest Ophthalmol Vis Sci*. 2003;44:5075–81.
2. Keel S, Xie J, Foreman J, Lee PY, Alwan M, Fahy ET, et al. Prevalence of glaucoma in the Australian National Eye Health Survey. *Br J Ophthalmol*. 2019;103:191–5.
3. Tham YC, Li X, Wong TY, Quigley HA, Aung T, Cheng CY. Global prevalence of glaucoma and projections of glaucoma burden through

2040: a systematic review and meta-analysis. *Ophthalmology*. 2014;121:2081–90.
4. Pascolini D, Mariotti SP. Global estimates of visual impairment: 2010. *Br J Ophthalmol*. 2012;96:614–8.
5. Wong EY, Keeffe JE, Rait JL, Vu HT, Le A, McCarty PhD C, et al. Detection of undiagnosed glaucoma by eye health professionals. *Ophthalmology*. 2004;111:1508–14.
6. Soh Z, Yu M, Betzler BK, Majithia S, Thakur S, Tham YC, et al. The global extent of undetected glaucoma in adults: a systematic review and meta-analysis. *Ophthalmology*. 2021;128:1393–404.
7. The Commonwealth Fund. International Profiles of Health Care Systems. Available from: https://www.commonwealthfund.org/international-health-policy-center/system-profiles. Accessed 20 Jul 2023.
8. Australia Government. Total Medicare statistics. Available from: https://www.health.gov.au/sites/default/files/2023-08/medicare-statistics-year-to-date-dashboards.pdf. Accessed 18 Nov 2023.
9. InSight. Optometry among top Medicare bulk billing health professions. Available from: https://www.insightnews.com.au/optometry-among-top-medicare-bulk-billing-health-professions/#:~:text=The%20Federal%20Government%20released%20its,drop%20from%20the%2097%25%20rate. Accessed 18 Nov 2023.
10. Weinreb RN, Leung CK, Crowston JG, Medeiros FA, Friedman DS, Wiggs JL, et al. Primary open-angle glaucoma. *Nat Rev Dis Primers*. 2016;2:16067. https://doi.org/10.1038/nrdp.2016.67
11. Wijesundera C, Vingrys AJ, Wijeratne T, Crewther SG. Acquired visual deficits independent of lesion site in acute stroke. *Front Neurol*. 2020;11:705. https://doi.org/10.3389/fneur.2020.00705
12. Crabb DP, Smith ND, Glen FC, Burton R, Garway-Heath DF. How does glaucoma look?: patient perception of visual field loss. *Ophthalmology*. 2013;120:1120–6.
13. Khoury JM, Donahue SP, Lavin PJ, Tsai JC. Comparison of 24-2 and 30-2 perimetry in glaucomatous and nonglaucomatous optic neuropathies. *J Neuroophthalmol*. 1999;19:100–8.
14. Australian Government. Medicare item reports. Available from: http://medicarestatistics.humanservices.gov.au/statistics/mbs_item.jsp. Accessed 15 Jul 2023.
15. Australian Government Services Australia. Pharmaceutical benefits schedule item reports. Available from: http://medicarestatistics.humanservices.gov.au/statistics/pbs_item.jsp. Accessed 1 Jun 2023.
16. Australian Government. Medicare is Australia's universal health care system. Available from: https://www.servicesaustralia.gov.au/about-medicare?context=60092. Accessed 5 Jul 2023.
17. Optometry Australia. Australian optometrists top 6,000 and two-thirds are therapeutically endorsed. Available from: https://www.optometry.org.au/workforce/australian-optometrists-top-6000-and-two-thirds-are-therapeutically-endorsed/. Accessed 14 Nov 2023.
18. Evidence reviews for selective laser trabeculoplasty in ocular hypertension or chronic open-angle glaucoma adult patients. London: National Institute for Health and Care Excellence; 2022.
19. Optometry Board of Australia. Guidelines for use of scheduled medicines. 2014. Available from: https://www.optometryboard.gov.au/. Accessed 14 Nov 2023.
20. Gazzard G, Konstantakopoulou E, Garway-Heath D, Garg A, Vickerstaff V, Hunter R, et al. Selective laser trabeculoplasty versus eye drops for first-line treatment of ocular hypertension and glaucoma (LiGHT): a multicentre randomised controlled trial. *Lancet*. 2019;393:1505–16.
21. Jan CL, Stafford RS, Shang X, Henwood J, Davey C, Liu J, et al. Analysing diagnostic practices and referral pathways for glaucoma in Australian primary eye care. *Ophthalmic Physiol Opt*. 2025;45:1211–20.
22. Newman AR, Andrew NH. Changes in Australian practice patterns for glaucoma management. *Clin Experiment Ophthalmol*. 2019;47:571–80.
23. Vaahtoranta-Lehtonen H, Tuulonen A, Aronen P, Sintonen H, Suoranta L, Kovanen N, et al. Cost effectiveness and cost utility of an organized screening programme for glaucoma. *Acta Ophthalmol Scand*. 2007;85:508–18.
24. Burr JM, Mowatt G, Hernández R, Siddiqui MA, Cook J, Lourenco T, et al. The clinical effectiveness and cost-effectiveness of screening for open angle glaucoma: a systematic review and economic evaluation. *Health Technol Assess*. 2007;11:iii–iv, ix–x, 1–190.
25. Hernández RA, Burr JM, Vale LD. Economic evaluation of screening for open-angle glaucoma. *Int J Technol Assess Health Care*. 2008;24:203–11.
26. Rein DB, Wittenborn JS, Lee PP, Wirth KE, Sorensen SW, Hoerger TJ, et al. The cost-effectiveness of routine office-based identification and subsequent medical treatment of primary open-angle glaucoma in the United States. *Ophthalmology*. 2009;116:823–32.
27. Khawaja A, Sherratt M, Sparrow J. The Royal College of Ophthalmologists' glaucoma commissioning guidance: executive summary. *Eye*. 2017;31:818–22.
28. Tang J, Liang Y, O'Neill C, Kee F, Jiang J, Congdon N. Cost-effectiveness and cost-utility of population-based glaucoma screening in China: a decision-analytic Markov model. *Lancet Glob Health*. 2019;7:e968–e978.
29. Submission from the Royal Australian and New Zealand College of Ophthalmologists (RANZCO) to AHPRA regarding 'Guidelines for the use of Scheduled medicines by Optometrists'. Available from: https://ahpra-search.clients.funnelback.com/s/redirect?collection=ahpra-websites-web&url=https%3A%2F%2Fwww.optometryboard.gov.au%2Fdocuments%2Fdefault.aspx%3Frecord%3DWD13%252f9932%26dbid%3DAP%26chksum%3Db9eOXSZd%252fFr0M8IVYFgVeA%253d%253d&auth=LbhgdVLSItOt6Ilda21p8Q&profile=optometry&rank=6&query=submissions+received+on+the+use+of+optometrists+of+glaucoma. Accessed 18 Jan 2013.
30. Submission from the Royal Australian and New Zealand College of Ophthalmologists (RANZCO) to AHPRA regarding 'Guidelines for the use of Scheduled medicines by Optometrists'. Available from: https://ahpra-search.clients.funnelback.com/s/redirect?collection=ahpra-websites-web&url=https%3A%2F%2Fwww.optometryboard.gov.au%2Fdocuments%2Fdefault.aspx%3Frecord%3DWD13%252f9932%26dbid%3DAP%26chksum%3Db9eOXSZd%252fFr0M8IVYFgVeA%253d%253d&auth=LbhgdVLSItOt6Ilda21p8Q&profile=optometry&rank=6&query=submissions+received+on+the+use+of+optometrists+of+glaucoma. Accessed 1 Feb 2013.
31. Daniels B, Healey P, Bruno C, Kaan I, Zoega H. Medicine treatment of glaucoma in Australia 2012–2019: prevalence, incidence and persistence. *BMJ Open Ophthalmol*. 2021;6:e000921. https://doi.org/10.1136/bmjophth-2021-000921

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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