This document is the text version of fthe presentation titled ‘Introducing an Australian bioptic driving framework’ April 2020 (the presentation is 42 pages in length with this text based version being 40 A4 pages in length. Each new page is numbered with the word ‘Page’ and then a number with those words in bold)

**Page 1** - title page

Introducing an Australian Bioptic Driving Framework

**Page 2** - Agenda

Introducing an Australian bioptic driving framework

1.Executive summary

2.Bioptic driving and opportunity sizing–Central vision loss & key challenges–Driving with bioptic telescopes–Bioptic driving opportunity sizing for Australia

3.Current Australian situation and potential benefits–Bioptic driving in Australia–Key benefits from bioptic driving–Success stories

4.Global case studies and research safety–Lessons learned from global references–Safety considerations & research

5.Key elements for an Australian framework

**Pages 3** - title page

1. Executive summary

A formalised bioptic driving framework has the potential to enable many Australians to pursue more independence through driving, and can be implemented with changes to the Assessing Fitness to Drive guidelines.

**Page 4** - Executive summary overview page

A bioptic driving framework, shown to be comparably safe, can remove discrimination and enable many Australians to gain independence through driving

Executive Summary overview:

Up to 228k Australians with central vision loss could benefit from bioptic driving

1.0 Central vision loss presents challenges that reduce independence & wellbeing, e.g. limiting the ability to drive; however, bioptic telescopes can address this issue

2.0 An estimated 228k Australians with central vision loss could benefit from bioptic driving

○63k live in smaller cities, rural & remote areas, in which not driving is more impactful

○86k are within studying & working age, which could have additional benefits in job seeking and access to higher education

Bioptic driving is currently limited in Australia, but greater use can deliver many benefits

3.0 Access to bioptics in Australia is limited due to:

○Unclear regulation on how bioptic devices apply to vision requirements to drive, resulting in inconsistent assessment of potential bioptic users

○Unfamiliarity amongst eye professionals, resulting in low prescription of bioptics

○Low awareness of the technology amongst potential users

4.0 Bioptic driving can deliver social & economic benefits:

○Increased independence and inclusion for users

○Better access to employment and educational opportunities

○Enhanced wellness and healthcare access with potentially reduced system costs

Global cases and research show that a framework increases access and that bioptic driving is comparably safe

5.0 Key global case (USA, Canada and Netherlands) learnings are that a uniform bioptic driving framework can increase access to bioptics, ensure consistent assessments and deliver appropriate training

6.0 Global cases & research support comparable safety of bioptic driving:

○Globally, no jurisdiction which implemented bioptic driving has revoked those privileges

○Authorities that commissioned research permit bioptic driving

○Research shows that bioptic drivers’ performance is, at maximum, comparable to the general public and, at minimum, comparable to many groups with higher collision rates that are permitted to drive

7.0 Global cases also suggest that a bioptic driving framework should include training and multi- disciplinary assessment

An Australian bioptic driving framework is needed to remove current discrimination, along with education & awareness efforts

Going forward, next steps include:

○Engage govt. stakeholders to support a formalised biopic driving framework for Australia, with clear rules in the Assessing Fitness to Drive guidelines

○Training and education initiatives to increase familiarity with bioptics for eye health, rehabilitation & driving instruction professionals

○Information efforts to increase awareness about bioptic driving amongst potential users

**Page 5** - Executive summary 1.0 Expanded

Central vision loss presents challenges through reduced independence; bioptic devices can help by enabling driving

1.1 Central vision loss & bioptic driving

1. Many individuals with central vision loss don’t have the opportunity to drive

•Central vision loss (CVL) is a loss of discrimination of visual detail while other aspects important for driving are intact (e.g. visual field & contrast sensitivity)

•Many conditions can cause CLV, such as diabetic retinopathy, macular & retinal dystrophies and albinism

•Many individuals with low vision never have the chance to drive or be evaluated for obtaining a licence

1. Denial of driving privileges limits independence for individuals with CVL in many ways:

•Commuting to work, university or health-related appointments

•Doing shopping and groceries alone

•Picking up children at school and childcare

•Visiting friends and family and engage in community activities Attending leisure & cultural activities)

1. Bioptic telescopes can help individuals with CVL to drive

•Bioptics are an assistive device that allow seeing details at a distance

•Bioptic devices are usually mounted at the top of regular glasses

•Drivers view the road through regular glasses most of the time (wide vision field) and quickly tilt their heads down to see details through the bioptics (~1 sec)

Image of a person wearing a bioptic sitting on spectacles.

The quick head movement is comparable to checking side mirrors, which enable drivers to maintain their attention and peripheral vision.

Sources: Bioptic Driving USA, Bioptic Drivers Australia, Ocutech, experts interviews

**Page 6** - Executive summary 1.2 expanded

Up to 228k Australians could benefit from bioptic driving, including 63k in regional areas and 86k at working age

1.2 Bioptic driving opportunity sizing for Australia, ‘000 people

628k Australians have medical conditions that could cause central vision loss

348k of them don’t have low vision, and 53k are too young to or chose not to drive

228k Australians are potential users of bioptic driving

Bar diagram shows:

628k Australians w/ conditions linked to central vision loss

348k Individuals w/ no low vision (acuity 6/12 or better1)

53k Individuals too young or that choose not to drive

228ik Potential users of bioptics for driving

Box shows out of 228k potential users of bioptic driving in Australia:

164k live in major cities and could enhance community connections

86k are at working & studying age and could drive to work or educational facilities

63k live in smaller communities, typically w/ public transport issues

141k potential users are older drivers, a group to which driving is also important

0.5k to 2k Expected to effectively undergo training and qualify for driving, based on USA figures for the population comparison of 10,000 bioptic drivers in 2016.

Notes: 1) Visual acuity (VA) refers to the clarity of vision and is expressed in a fraction, e.g. 6/12 means that a person with disability can see with clarity 12 mts far where a person with no disability would be able to see with clarity 6 mts far. 2) Driving is one of the more important activities of daily living for elderly patients and, when faced with driving cessation as a result of vision loss, these patients reported higher levels of depressive symptoms - Chun et al. Current Perspectives of Bioptic Driving in Low Vision, Neuroophthalmology (2016). Sources: ABS, Albinism Fellowship of Australia, Sarvananthan et al (2009), Musch et al. (2011), National Eye Institute, Sahel et al. (2015), Orssaud (2002), US National Library of Medicine (2020), Osborne and Balcer (2020), Taylor (2005), Roy Morgan (2016).

**Page 7** - Executive summary 1.3 expanded

Access to bioptics in Australia is currently limited due to unclear regulations, unfamiliarity and low awareness

1.3 Bioptic driving in Australia

Firstly, Unclear regulation and no standards for bioptic driving

• The Assessing Fitness to Drive (AFTD) guidelines allow candidates to meet medical standards and qualify for conditional licences with corrective lenses, but are not clear how bioptic devices are included

• The AFTD guidelines also determine that

no standards are set for bioptic telescopes

• As a result, the ruling for bioptic driving is open to interpretation by each state’s driver licensing authority, generating inconsistency in the assessment of potential bioptic users.

Secondly, Unfamiliarity with bioptics in the eye health community

• The AFTD guidelines recommend that potential users of bioptic devices be assessed by eye professionals with expertise in the technology

• However, most eye health professionals are unfamiliar with bioptics and there are few bioptic experts in Australia

• As a result, few professionals prescribe bioptics and potential users might need to travel to consult with specialists, making it an expensive and restrictive process.

Thirdly, Low awareness amongst potential bioptic users

• Many individuals with CVL assume that they will never drive or are told so by their eye health professionals, especially those born with certain medical conditions (e.g. albinism)

• Also, many individuals with CVL never have a chance to be comprehensively assessed and demonstrate driving proficiency

• As a result, most potential users of bioptic devices for driving are unaware of them

Sources: Austroads, National Transport Commission (NTC), Bioptic Drivers Australia, experts interviews

**Page 8** - Executive summary 1.4 expanded

Non-discriminatory access to driving can deliver social and economic benefits

1.4 Key benefits from bioptic driving

1. Greater inclusion, non-discrimination

A clear framework for bioptic driving can remove barriers and enable thousands of Australians to be assessed to drive, in line with a social model of disability and non-discrimination principles

1. Access to employment & education

~40% of potential Australian bioptic driving users are of working or studying age, with the potential for increased access to employment1 and educational opportunities, potentially reducing welfare spend for the government

1. Better transport options

~30% of potential Australian bioptic users live outside major cities, with limited public transport options. Driving gives them an alternate option for transport, reducing travel time and increasing ease of movement

1. Increased independence & wellness

Being able to drive independently can increase social connections and access to healthcare & wellness activities. This is also likely to increase the demand for eye health, occupational therapy, rehabilitation and driving instruction professionals

1. Improved self-esteem and mental health

Potentially reduced need for medical and social care3, including mental health related costs, as non-drivers typically show higher risk of depression2 and increased care needs

Quotes from bioptic drivers:

“My world has expanded beyond from where I can walk to and from and I can help others too.” - Ron K (USA)

“After not driving for about a full year I regained an Indiana driver’s licence and my life began to change. I felt I could return to my old job and be successful. I applied with my old employer and was hired to return to work doing what I have done as a career and what I love doing.” - Michael S (USA)

 “My driving licence expired and I was fired from my job, because I live in a rural area with no public transportation to work. My life came to a standstill!” - Richard B (USA)

“I live in the country and driving is a must as everything is at least half an hour away and I had no neighbor who could take me or a taxi service to use.” - Nina B (USA)

 "It's pretty cool. [Until now] I've always been relying on people.” - Tommy Roberts (New Zealand)

“I can’t describe how happy and elated I felt afterwards it truly is a dream come true, I have never given up looking for a way to drive since I turned about 17” - Robert Eaves (Australia)

“Bioptic driving gives me the ability to take myself to work. It gives me the ability to go grocery shopping when I want to go, not just when someone else is going.” - Sharon D (USA)

Notes: (1) Crudden, Adele & McBroom, L., Barriers to employment: A survey of employed persons who are visually impaired, Journal of Vision Impairment and Blindness (1999) (2) David R. Ragland, William A. Satariano, Kara E. MacLeod, Driving Cessation and Increased Depressive Symptoms, The Journals of Gerontology (2005) (3) MDFA (2017). MDFA Low Vision Report 2017 (4) Yu-Chen Lee et al (2017). Cost of high prevalence mental disorders: Findings from the 2007 Australian National Survey of Mental Health and Wellbeing. Australian & New Zealand Journal of Psychiatry, 51(12), 1198-1211 (5) Calculation based on Australian Government Services Australia (2020). How much you can get (6) Calculation based on ABS (2019). Moderate growth in average earnings.

Improved self-esteem and mental health

**Page 9** - Executive summary 1.5 expanded

Global cases show that a bioptic driving framework can increase access and standardise assessment and training

1.5 Lessons learned from global references in bioptic driving

USA - Key learnings

• Bioptic driving rules vary across states and generate inconsistency, e.g.

○ Different visual acuity requirements (most states require VA 6/12 to 6/20, but some allow 6/60 up to 3/60, often with restrictions)

○ Whether bioptics can be used to meet standards and pass tests (some states allow it, some don’t and some are unclear)

○ Restrictions vary for similar cases in different states (e.g. daytime only, max. speed, etc.)

Canada - Key learnings

• Rules clearly define that candidates can use bioptics to meet visual acuity criteria

• Candidates are holistically assessed by a team of multidisciplinary professionals

• A comprehensive bioptic driving program is utilised to enhance training and safety, and includes pre-training on a simulator

• Bioptic drivers undergo periodic visual and driving re-evaluations

Netherlands - key learnings

• A national bioptic driving framework was introduced in 2009 based on USA rules adapted to the Netherlands’ reality

• Candidates are holistically assessed by a team of multidisciplinary professionals

• Specific rules are used to assess night time driving and apply restrictions as needed

USA - Takeaways for an Australian perspective

• A national framework should be introduced (e.g. in the Assessing Fitness to Drive guidelines) to increase consistency in candidate assessment and the application of rules

Canada - Takeaways for an Australian perspective

• Assessment guidelines should clearly define when bioptics can be used to meet criteria

• A multidisciplinary approach should be used to holistically assess candidates

• A structured bioptic training approach should be used to assess candidates throughout the process, enhancing safety

• Periodic reviews ensure bioptic drivers are maintaining visual and driving proficiency

Netherlands - Takeaways for an Australian perspective

• Countries should draw on international cases to develop national frameworks

• A multidisciplinary approach should be used to holistically assess candidates

• Restrictions might be introduced based on functional capability and local conditions

Source: Bioptic Drivers Australia, Bioptic Driving USA, Williams OT, SME interviews

**Page 10** - Executive summary 1.6 expanded

Global cases and research support the comparable safety of bioptic driving

1.6 Safety considerations & research

Bioptic driving has been proven to be comparably safe globally...

40 years of bioptic driving globally

3 countries1 have bioptic driving frameworks

(including 45 independently regulated USA states)

0 jurisdictions have revoked bioptic driving

(including where driving authorities commissioned safety research)

 ...with research further supporting its comparable safety

1. Studies show that bioptic drivers have, at maximum, comparable performance to average population and, at minimum, comparable performance to many groups that have higher collision rates than the average of the population and are permitted to drive (e.g. hearing impairments, cognitive impairment, heart disease, etc.)2
2. Research also demonstrates that driving with bioptic telescopes does not increase risk of accidents and offenses when a bioptic training program is completed3
3. Contrary to common misconceptions, the majority of bioptic users continue to employ the device after obtaining their licences4-5
4. Traditional medical standards such as visual acuity, visual field and contrast sensitivity might not be accurate indicators to predict safety, and factors such as age and driving experience might be more significant 2-3,6

Quote:“There really [is] no evidence to support excluding bioptic drivers if one both reads the papers and considers the question logically”7

Dr. Eli Peli

Professor of Ophthalmology at Harvard University and Co-Director of Harvard’s Mobility Enhancement and Vision Rehabilitation Center of Excellence

Refer to pages 28, 32 and 33 for details on global cases and research about safety

Notes: 1) USA, Canada and Netherlands 2) Peli, Driving with low vision: who, where, when and why (2008) 3) Vincent et al. Driving Performance Among Bioptic Telescope Users

with Low Vision Two Years After Obtaining Their Driver's License, Assistive Technology (2012). 4) Bowers et al. Bioptic Telescopes Meet the Needs of Drivers with Moderate

Visual Acuity Loss, Invest Ophthalmol Vis Sci. (2005). 5) Owsley et al. Visually impaired drivers who use bioptic telescopes: self-assessed driving skills and agreement with

on-road driving evaluation, Invest Ophthalmol (2014). 6) Dougherty et al. Previous driving experience but not vision, is associated with motor vehicle collision rate in bioptic

drivers, Invest Ophthalmol (2015). Source: BDA, Bioptic Driving USA, Ocutech, experts interviews 7) Interview with Dr. Eli Peli, based on Driving with low vision: who, where,

when, and why. In: Albert and Jakobiec's Principles and Practice of Ophthalmology, manuscript submitted for publication. 10

**Page 11** - Executive summary 1.7 expanded

Based on global cases, a bioptic driving framework should include specific training and a multidisciplinary assessment

1.7 Key elements for an Australian bioptic driving framework

Diagram of a user centre model of four quadrants with bioptic driving candidate in middle

 1.7.A-Specific bioptic assessment & training:

● Specify in the Assessing Fitness to Drive guidelines that medical standards can be met with corrective lenses including bioptic devices and colour differentiation filters

● Introduce a bioptic pre-driving program including practical usage, risk mitigation and commentary driving techniques

● Create specific bioptic driving practical training with bioptic driving instructors held in different conditions to inform licence restrictions (e.g. daytime only)

● Consult with the bioptic driving and low vision community to continuously improve assessment & training

1.7.B-Potential exits along the process:

● Design the process to allow candidates to exit at different stages, versus the current situation in which most candidates are held at the eligibility assessment stage

● As a result, more candidates are expected to progress through the process and have a chance to demonstrate driving proficiency with bioptics

Bioptic driving candidates

1.7.C-Multidisciplinary candidate assessment:

● Assess candidates with a team of multidisciplinary professionals (eye health, rehabilitation, occupational therapy & driving instructor professionals)

● Multiple professionals to provide inputs in assessment outcomes, e.g. to inform potential restrictions on licences and use of compensatory supports

● As a result, the driving fitness assessment decisions are shared amongst professionals (versus current decisions that are held mainly by eye professionals)

1.7.D-Enhanced periodic review and support:

● Conditional licence periodic reviews to include functional vision & practical driving tests for some profiles (e.g. first time, younger or drivers w/ degenerative conditions)

● Recommend drivers to engage with the bioptic community for peer support and to complete defensive driving instruction to enhance driving proficiency

Source: Experts interviews, analysis based on global case studies

**Page 12** - title page: 2. Bioptic driving and opportunity sizing

Central vision loss presents challenges through reduced independence that can be addressed by bioptic devices, and up to 228k Australians could benefit from bioptic driving

**Page 13** - Bioptic driving and opportunity sizing

Central vision loss presents challenges that limit independence and reduce wellbeing

2.1 Central vision loss definition and impacts

Central vision loss is a type of low vision with different causes

• CVL1 is a loss of discrimination of visual detail while other aspects important for driving are intact (e.g. visual field & contrast sensitivity)

• Many conditions can cause CVL, e.g.:

○ Diabetic retinopathy

○ Macular dystrophies (e.g. macular degeneration and Stargardt’s disease)

○ Retinal dystrophies

○ Albinism

○ Optic nerve conditions

CVL includes both:

• Individuals born with certain medical conditions and which are generally stable

(e.g. albinism)

• Individuals who acquired CVL through a disease or injury, to whom the condition can be stable or progressive (e.g. macular degeneration)

Many people with central vision loss don’t have the opportunity to drive

• Individuals with low vision have some functional vision

• However, vision loss might impact performance of vocational, recreational and social activities

• Many individuals with low vision never have the chance to drive or be evaluated for obtaining a licence

• As a result, they face challenges, e.g. job seeking, access to education and limited independence

Denial of driving privileges limits independence for individuals with CVL in many ways

Commuting to work, university or health-related appointments

Doing shopping and groceries alone

Picking up children at school and childcare

Visiting friends and family and engage in community activities

Attending leisure & cultural activities

Notes: 1) Central vision loss is a result of a degeneration of the fovea (the centre of the retina, with sharper visual acuity) Sources: VisAbility, Vision 2020 Australia, SME interviews

**Page 14** - Bioptic driving and opportunity sizing

Barriers in mobility are one of the main challenges faced by individuals with central vision loss

Challenges in transportation

“Few things are more fundamental than the ability to get where one needs to go. Without access to transport, participation in critical activities such as education, employment and health care is difficult, if not impossible”

National People with Disabilities and Carer Council1

Of individuals with visual disabilities, 17% reported transportation difficulties as the

biggest challenge in obtaining employment2

Depression in former drivers is higher, 21% versus 8% in current ones; possible correlation

between stop driving & depression3

Notes: 1) Shut Out: The Experience of People with Disabilities and their Families in Australia (2009); 2) Crudden, Adele & McBroom, L., Barriers to employment: A survey of

employed persons who are visually impaired, Journal of Vision Impairment and Blindness (1999); 3) David R. Ragland, William A. Satariano, Kara E. MacLeod, Driving

Cessation and Increased Depressive Symptoms, The Journals of Gerontology (2005)

**Page 15** - Bioptic driving and opportunity sizing

Bioptics are an assistive device that can help to see details at a distance, and are highly valued by users

Bioptic driving

Bioptics can address challenges

• The challenge for drivers with CVL is needing to get too close to see details clearly, with less time for adjustments

• Bioptic telescopes allow drivers with CVL to see targets sooner, increasing

reaction time

This diagram shows a Traffic sign viewed from a 5 degree field of view with 3x galilean bioptic

This diagram shows Traffic sign viewed from a 12 degree field of view with 3x keplerian bioptic (to describe the pictures, it shows the first diagram has a narrower field of view when looking at the same road sign from each bioptic)

Bioptics are an assistive device

• Bioptic telescopes are an assistive device that allow seeing details at a distance

• Bioptic devices are usually mounted at the top of regular glasses

• Drivers view the road through regular glasses most of the time (wide vision field) and quickly tilt their heads down to see details through the bioptics (~1 sec)

The quick head movement is comparable to checking side mirrors, which enable drivers to maintain their attention and peripheral vision

Users greatly value bioptics

• The majority of bioptic drivers find the telescopes essential as an

assistive device for driving tasks1:

74% of users rate bioptic telescopes as very helpful2

90% of user would continue to use it for driving, even if it were not required for their driving

Licence2

Notes: 1) Owsley, C. et al., Visually Impaired Drivers Who Use Bioptic Telescopes, Investigative Ophthalmology and Visual Science (2014)

2) Bowers AR, Apfelbaum DH, Peli E., Bioptic Telescopes Meet the Needs of Drivers with Moderate Visual Acuity Loss, Invest Ophthalmol Vis Sci. (2005)

Sources: Bioptic Driving USA, Bioptic Drivers Australia, Ocutech, experts interviews

**Page 16** - Bioptic driving and opportunity sizing

A social model of disability can offer equal opportunity to low vision individuals with driving performance assessments

Medical vs social model of disability

Diagram shows less inclusive at the medical model and more inclusive at the social model

Medical model of disability - description

• Contends that individuals are disabled by their impairments or differences

• Creates low expectations (e.g. what is ‘wrong’ with the person, not what they need)

• Focuses on arbitrary classifications (e.g.,‘legally blind’), not what a person can actually do

• Leads to exclusion and loss of independence

Social model of disability - description

• Contends that individuals are disabled by barriers in society

• Focuses on actual functional capability (e.g. what the person can accomplish)

• Leads to equality and inclusion of individuals as functional citizens

• Is consistent with the United Nations Convention on the Rights of Persons with Disabilities, of which Australia is a signatory

Medical model of disability - implications

• Many individuals low vision are denied an opportunity to be evaluated for a drivers’ licence because of a certain visual acuity1

• Case-by-case evaluation is difficult in the current system (focused on acuity and field)

• Only those fortunate enough to have an eye health professional knowledgeable about bioptic

driving have a chance

Social model of disability - implications

• More individuals with low vision are given the chance to utilise bioptics, a proven assistive

device, to pursue driving qualifications

• Even with equal opportunity, a bioptic user is only allowed to drive after demonstrating adequate driving proficiency & functional vision

Removing barriers allow individuals with disabilities to be more independent & equal in

society:

• Institutional barriers: Laws and policies that discriminate against individuals with disabilities

• Attitudinal barriers: Discrimination and low expectations of individuals with disabilities

• Environmental barriers: Inaccessible environments preventing inclusion

Notes: 1) Visual acuity (VA) refers to the clarity of vision and is expressed in a fraction, e.g. 6/12 means that a person with disability can see with clarity 12 mts far where a person

with no disability would be able to see with clarity 6 mts far

Source: Australian Federation of Disability Organisations (AFDO)

**Page 17** - Bioptic driving and opportunity sizing

Up to 228k Australians could potentially benefit from bioptic driving, with 0.5k to 2k likely qualifying to drive

Bioptic driving opportunity sizing for Australia

628k Australians have medical conditions that could cause central vision loss

348k of them don’t have low vision, and 53k are too young to or chose not to drive

228k Australians are potential users of bioptic driving

• Individuals with different conditions might develop CVL, e.g.:

○ Diabetic retinopathy

○ Macular dystrophies (e.g. macular degeneration and Stargardt’s disease)

○ Retinal dystrophies

○ Albinism

○ Optic nerve conditions

○ Other conditions (e.g. corneal dystrophies, congenital nystagmus, achromatopsia, etc.)

• Bioptic telescopes can help individuals with low vision (VA1 worse than 6/12) to pursue driving qualifications; 348k individuals with VA better than 6/12 were excluded from sizing

• The minimum age to drive in most Australian states & territories is 16;

5k individuals not eligible to drive were excluded from sizing

• On average, 81%2 of individuals eligible to drive choose not to, therefore 48k individuals were excluded

Graph showing Potential users of bioptic driving, ‘000 people

Bar diagram shows:

628k Australians w/ conditions linked to central vision loss

348k Individuals w/ no low vision (acuity 6/12 or better1)

53k Individuals too young or that choose not to drive

228ik Potential users of bioptics for driving

0.5-2k Potential users expected to effectively undergo training and qualify for driving, based on USA figures1

Refer to page 20 for details on assumptions

Notes: 1) Visual acuity (VA) refers to the clarity of vision and is expressed in a fraction, e.g. 6/12 means that a person with disability can see with clarity 12 mts far where a person with no disability would be able to see with clarity 6 mts far. 2) Roy Morgan, Australians aged 80+ more likely to drive than 18-24 year-olds (2016). 15–24yrs: 53%, 25–34yrs: 82%, 35–44yrs: 92%, 45–54yrs: 93%, 55–64yrs: 93%, 65–74yrs:89%, 75–84yrs: 77%, "85+ yrs: 69%.

Sources: Australian Bureau of Statistics, Albinism Fellowship of Australia, Sarvananthan et al (2009), Musch et al. (2011), National Eye Institute, Sahel et al. (2015), Orssaud (2002), US

National Library of Medicine (2020), Osborne and Balcer (2020), Taylor (2005), Roy Morgan (2016). Austroads, SME interviews

**Page 18** - Bioptic driving and opportunity sizing

NSW, VIC and QLD are estimated to account for the most cases of central vision loss, including those in rural areas

Potential users of bioptic driving — geographic distribution, ‘000 people

Australia wide:

Potential all: 228k

Potential not living in major cities: 63k

NT

Potential all: 2k

Potential not living in major cities: 2k

WA

Potential all: 24k

Potential not living in major cities: 5k

SA

Potential all: 16k

Potential not living in major cities: 4k

TAS

Potential all: 5k

Potential not living in major cities: 5k

VIC

Potential all: 59k

Potential not living in major cities: 13k

ACT

Potential all: 4k

Potential not living in major cities: 0k

NSW

Potential all: 73k

Potential not living in major cities: 18k

QLD

Potential all: 46k

Potential not living in major cities: 16k

~228k total potential candidates for bioptic driving were apportioned by state in proportion to total Australian population1

Australians in rural and remote areas

• ~28% of potential users (63k individuals with central vision loss) live outside major cities, facing challenges that often result in poorer health and worse economic outcomes2

• Due to disadvantages in education, employment and income, their household net worth is 29% lower than national average2-3

• Those Australians also have lower access to services3, including public transport, making bioptic driving even more impactful

Aboriginal & Torres Strait Islander pop.

• The Aboriginal and Torres Strait Islander population has 6 times higher rates of blindness compared to national averages4

• 94% of vision loss issues faced by this population are preventable or treatable4

NOTES: 1) ABS, Regional Population Growth (2020). 2) Australian Institute of Health and Welfare, Australia's Health (2018). 3) Australian Institute of Health and Welfare, Rural and

Remote Health (2019). 4) Taylor and Stanford, Provision of Indigenous Eye Health Services (2010)

Sources: SME interviews

**Page 19** - Bioptic driving and opportunity sizing

Sociodemographic factors impact health outcomes, the elderly population are the largest group of potential bioptic users

Potential users of bioptic driving — age & visual acuity distribution, ‘000 people

Table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Acuity | totals | 15-44 yrs | 45-64 yrs | 65-74 yrs | 75 yrs + |
| Individuals w/mild CVL(VA1 6/12 to6/24) | 37 | 2 | 12 | 8 | 15 |
| Individuals w/moderate CVL(VA1 6/24 to6/60) | 37 | 2 | 12 | 8 | 15 |
| Individuals w/ severe CVL(VA1 worst than 6/60) | 153 | 9 | 49 | 35 | 60 |
|  | 227 | 14k | 72 | 51 | 91 |

Age distribution

• 86k are at working & studying age and could drive to work or educational facilities

• 141k potential users are older drivers (65 years+), a group to which driving is also important2

Visual acuity distribution

• According to the AFTD guidelines:

○ Individuals with VA equal or better to 6/12 can obtain unconditional licences

○ 37k individuals with VA1 between 6/12 to 6/24 (mild CVL) can obtain a conditional licence with the assistance of corrective lenses (no clarity on whether bioptics are allowed to meet the standard)

○ Individuals with VA worse than 6/24 (including 37k individuals with VA 6/24 to 6/60 and 153k with VA worst than 6/60) cannot obtain a driver licence without a bioptic (no clarity on how bioptic telescopes are allowed to meet the standard and thus obtain

conditional licences)

• Changing and clarifying the AFTD guidelines can enable more individuals with CVL to drive with biotics

Refer to page 20 for details on assumptions

1) Visual acuity (VA) refers to the clarity of vision and is expressed in a fraction, e.g. 6/12 means that a person with disability can see with clarity 12 mts far where a person

with no disability would be able to see with clarity 6 mts far. 2) Driving is one of the more important activities of daily living for elderly patients and, when faced with driving

cessation as a result of vision loss, these patients reported higher levels of depressive symptoms - Chun et al. Current Perspectives of Bioptic Driving in Low Vision,

Sources: ABS, Austroads, National Transport Commission (NTC), experts interviews

**Page 20** - Bioptic driving and opportunity sizing

The number of Australians with central vision loss was estimated based on prevalence of related medical conditions

Opportunity sizing assumptions

Table:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  | Proportion of patient visual acuity1 |
| CVL Condition  | Calculatedprevalence | 6/12 orbetter | 6/12 - 6/24  | 6/24 - 6/60  | 6/60 orworse  | Sources |
| Diabetic retinopathy | 304k | 84% | 2% | 2% | 12% | Prevalence: ABS (2018), Centre for Eye Research Australia (2015)Visual Acuity: Taylor (2005). Assuming equal distribution between 6-12 and 6/60 |
| Maculardegeneration | 275k | 24% | 13% | 13% | 50% | Prevalence: ABS (2018)Visual Acuity: Taylor (2005). Assuming equal distribution between 6-12 and 6/60 |
| Corneal dystrophies | 22k | 54% | 7.5% | 7.5% | 31% | Prevalence: Musch et al. (2011)Visual Acuity: Assumption based on average visual acuity of AMD and DR |
| Congenitalnystagmus | 10k | 54% | 7.5% | 7.5% | 31% | Prevalence: Sarvananthan et al. (2009)Visual Acuity: Assumption based on average visual acuity of AMD and DR |
| Retinal dystrophies | 8k | 54% | 7.5% | 7.5% | 31% | Prevalence: Sahel et al. (2015)Visual Acuity: Assumption based on average visual acuity of AMD and DR |
| Stargardt’s disease | 3k | 54% | 7.5% | 7.5% | 31% | Prevalence: National Eye Institute (2019)Visual Acuity: Assumption based on average visual acuity of AMD and DR |
| Optic nerveconditions | 3k | 92% | 2.5% | 2.5% | 3% | Prevalence: Orssaud (2002), US National Library of Medicine (2020), Osborne and Balcer(2020). Including Hereditary Optic Atrophy, Leber Hereditary Optic Neuropathy (LHON) andOptic NeuritisVisual Acuity: Taylor (2005). Assuming equal distribution between 6-12 and 6/60. Using'neuro-ophthalmic' |
| Albinism | 1k | 0% | 33% | 33% | 33% | Prevalence: Albinism Fellowship of Australia (n.d.) (1 in 17,000)Visual Acuity: Assumption based on expert interviews |
| Achromatopsia (inall forms) | 0.8k | 0% | 20% | 50% | 30% | Prevalence: US National Library of Medicine (2020)Visual Acuity: Assumption based on expert interviews, Achromatopsia.info (n.d.) |

Notes: 1) Visual acuity (VA) refers to the clarity of vision and is expressed in a fraction, e.g. 6/12 means that a person with disability can see with clarity 12 mts far where a person

Bioptic Drivers Australia with no disability would be able to see with clarity 6 mts far

**Page 21** - Bioptic driving and opportunity sizing

With demographic changes in Australia, the number of individuals with central vision loss is expected to grow

Growth trends in central vision loss

Aging of the Australian population

• In 2017, there were 3.8m Australians aged 65+, expected to increase to 8.8m in 20571

• ~15% of 80+ y/o have central vision loss / blindness from age-related macular degeneration2, which could increase with an aging pop.

Growing number of diabetes cases

• Type 2 diabetes is the 12th most burdensome disease in Australia3 and 25-35% of diabetics

have diabetic retinopathy3

• Even though risk factors can generally be controlled3, diabetes is on the rise and almost doubled from 3.3% in 2001 to 6% in 2017-183

Increasing use of technology

• Australians, especially children, are spending more time with screens; blue light is associated with macular degeneration, and increased use can increase vision loss4-6

• New medical technology is becoming available to treat and prevent vision loss, such as intravitreal injections

• There is increased use of assistive technology in everyday life for individuals with vision loss, with bioptics being a key example

Notes: Sources: 1) Australian Institute of Health and Welfare, Older Australia at a glance (2018) 2) Macular Disease Foundation Australia, About Macular Degeneration (n.d.) 3)

Australian Institute of Health and Welfare, Diabetes (2019) 4) Macular Disease Foundation Australia, Risk Factors (n.d.) 5) Australian Bureau of Statistics, 8146.0 -

Household Use of Information Technology, Australia, 2016-17 (2018) 6) Zhi-Chun Zhao et al. Research progress about the effect and prevention of blue light on eyes, Int J

Ophthalmol (2018)

**Page 22** - title page: 3. Current Australian situation and potential benefits

Bioptic driving is currently limited in Australia, but a greater use can deliver many benefits as highlighted by users’ success stories

**Page 23** - Current Australian situation and potential benefits (content duplicates page 7)

Access to bioptics in Australia is currently limited due to unclear regulations, unfamiliarity and low awareness

1.3 Bioptic driving in Australia

Firstly, Unclear regulation and no standards for bioptic driving

• The Assessing Fitness to Drive (AFTD) guidelines allow candidates to meet medical standards and qualify for conditional licences with corrective lenses, but are not clear how bioptic devices are included

• The AFTD guidelines also determine that

no standards are set for bioptic telescopes

• As a result, the ruling for bioptic driving is open to interpretation by each state’s driver licensing authority, generating inconsistency in the assessment of potential bioptic users.

Secondly, Unfamiliarity with bioptics in the eye health community

• The AFTD guidelines recommend that potential users of bioptic devices be assessed by eye professionals with expertise in the technology

• However, most eye health professionals are unfamiliar with bioptics and there are few bioptic experts in Australia

• As a result, few professionals prescribe bioptics and potential users might need to travel to consult with specialists, making it an expensive and restrictive process.

Thirdly, Low awareness amongst potential bioptic users

• Many individuals with CVL assume that they will never drive or are told so by their eye health professionals, especially those born with certain medical conditions (e.g. albinism)

• Also, many individuals with CVL never have a chance to be comprehensively assessed and demonstrate driving proficiency

• As a result, most potential users of bioptic devices for driving are unaware of them

Sources: Austroads, National Transport Commission (NTC), Bioptic Drivers Australia, experts interviews

**Page 24** - Current Australian situation and potential benefits

Enabling individuals with low vision to drive improves their independence, social connection, education & wellness

Social benefits

Inclusion and Independence

• Greater inclusion will occur as a result of a social model of disability

• A clear framework for bioptic driving can enable up to ~228k people to be assessed to drive

• This will lead to increased Independence in activities of daily living

• Greater ease of movement and reduced reliance on public transportation, particularly important for those living in rural areas or who don’t have access to formal or informal care

• Stronger bonds with friends, family and the local community due to greater connection

Better access to education and culture

• Driving can increase access to employment1 and educational opportunities

• ~86k of potential bioptic driving users are of working or studying age

• Individuals may also have easier access to culture (e.g. museums, theatres, etc.)

• In some states individuals would not qualify for either obtaining a driving licence or taxi subsidies (e.g. in NSW a VA better than 6/12 required to drive and worse than 6/60 is required to qualify for taxi benefits)

Enhanced health and wellbeing

• Being able to drive independently can increase social connections and facilitate access to healthcare & wellness, for example attending doctors appointments or examinations

• This is particularly important for the ~63k potential bioptic users who live outside major cities, as they often have limited public transport options and may not live close to family and/or friends

• Increased social connection and greater independence reduces the risk of depression that may occur as a result of stopping driving2

Notes: Sources: 1) Crudden & McBroom, Barriers to employment: A survey of employed persons who are visually impaired, Journal of Vision Impairment and Blindness (1999) 2)

Ragland, William & MacLeod, Driving Cessation and Increased Depressive Symptoms, The Journals of Gerontology (2005)

**Page 25** - Current Australian situation and potential benefits

Increasing the number of bioptic drivers can also enable

economic benefits, such as potential govt. expense reduction

Economic benefits

Avoidance of health system costs and productivity losses

• Reduced independence can increase the need for medical care and social services1

• Expenditure can include: presentation and diagnostic costs, cost of treatment and monitoring, indirect costs for the treatment of anxiety and depression and the economic costs of rehabilitation1

• Annual healthcare sector costs associated with mental health is approximately $845pp2

• Further productivity costs of $11.8b to the country as a whole are also due to mental health conditions2

Reduction in welfare payments

• Individuals finding employment thanks to bioptic driving could potentially:

– Save the government in welfare (e.g. average $15k p.p. annually in JobSeeker or ~$22k

in Disability Support Pension)3

– Increase their revenue closer to national averages (~$86k annually)4

Stimulate job market

• A multidisciplinary bioptic driving framework is likely to increase demand for specialist services including eye health professionals, occupational therapists, rehabilitation specialists and driving instructors

• The demand for ophthalmology services is estimated to grow at 2.8% to 2030, with an undersupply predicted5

• Currently, 84 per cent of Australia’s ophthalmologists are located in MMM1, meaning only a small percentage are located in rural and remote areas5

Notes: Source: 1) MDFA, MDFA Low Vision Report (2017) 2) Yu-Chen Lee et al., Cost of high prevalence mental disorders: Findings from the 2007 Australian National Survey of

Mental Health and Wellbeing, Australian & New Zealand Journal of Psychiatry (2017) 3) Australian Government Services Australia, How much can you get (2020) 4) ABS,

Moderate growth in average earnings (2019) 5) Department of Health, Australia’s Future Health Workforce – Ophthalmology (2018)

**Page 26** - Current Australian situation and potential benefits

Bioptic driving has the potential of changing lives, as highlighted by success stories from real users

Success stories

Rob thought he would never drive

• Robert Eaves has albinism, nystagmus and astigmatism and was told all his life that he would never be able to drive

• In 2016 he read an article about bioptic driving and travelled from Adelaide to Sydney to meet a specialist

• Rob underwent training with an OT at the suggestion of his optometrist, as it was thought that this would teach him the best way to drive with the lens

• Rob collected his bioptic in November 2016 but only got his licence in July 2018, after extensive training & retaking his drivers' exam

Rebecca was always told she wouldn’t be able to drive

• Growing up with albinism, Rebecca was always told that she would be unable to drive

• She watched her family and friends get their their licence and gain their independence while she was still reliant on public transport and lifts from others

• Whilst she had known about bioptics in the 1990’s it wasn’t until 2018 that Rebecca realised it was something within her reach

• Working with a doctor in Sydney, Rebecca was prescribed a bioptic and gained her learner's permit in 2018, having now completed all required training with just the final test and driving assessment remaining

• Over this journey, Rebecca has worked closely with a driving instructor and OT team to identify challenges and develop solutions to ensure that she is a safe driver

Andrew has been driving for forty years

• Andrew first got his driver’s licence in his late teens

• His vision was described as fine until his early forties when he was diagnosed with Macular

Telangiectasia (Mactel)

• Whilst this did not cause too many problems at first for Andrew, he did notice some deterioration in his ability to read things at a distance (describing it as more annoying than a

significant problem)

• Andrew held a full unrestricted licence until 2019, where he fell just short of the minimum visual acuity. He obtained a conditional licence with distance restrictions

• Andrew came across Bioptics when researching driving aids and after several rounds of exams and consultations, he was fitted with a pair of bioptics and now uses them whenever he is driving

Notes: Sources: Bioptic Drivers Australia, Bioptic Driving USA, Ocutech, Williams OT, SME interviews

**Page 27** - title page: 4. Global cases and research safety

International examples show that a clear framework can increase access to bioptic driving and deliver appropriate candidate assessment and training, as well as address safety concerns as highlighted by extensive research

**Page 28** - Global cases and research safety (same content as p9 with some additions)

Global cases show that a bioptic driving framework can increase access and standardise assessment and training

4 Lessons learned from global references in bioptic driving

Framework in place?

USA - legal in one state in 1971 compared to 45 states in 2020

Canada - Yes

Netherlands - Yes.

USA - Key learnings

• Bioptic driving rules vary across states and generate inconsistency, e.g.

○ Different visual acuity requirements (most states require VA 6/12 to 6/20, but some allow 6/60 up to 3/60, often with restrictions)

○ Whether bioptics can be used to meet standards and pass tests (some states allow it, some don’t and some are unclear)

○ Restrictions vary for similar cases in different states (e.g. daytime only, max. speed, etc.)

Canada - Key learnings

• Rules clearly define that candidates can use bioptics to meet visual acuity criteria

• Candidates are holistically assessed by a team of multidisciplinary professionals

• A comprehensive bioptic driving program is utilised to enhance training and safety, and includes pre-training on a simulator

• Bioptic drivers undergo periodic visual and driving re-evaluations

Netherlands - key learnings

• A national bioptic driving framework was introduced in 2009 based on USA rules adapted to the Netherlands’ reality

• Candidates are holistically assessed by a team of multidisciplinary professionals

• Specific rules are used to assess night time driving and apply restrictions as needed

USA - Takeaways for an Australian perspective

• A national framework should be introduced (e.g. in the Assessing Fitness to Drive guidelines) to increase consistency in candidate assessment and the application of rules

Canada - Takeaways for an Australian perspective

• Assessment guidelines should clearly define when bioptics can be used to meet criteria

• A multidisciplinary approach should be used to holistically assess candidates

• A structured bioptic training approach should be used to assess candidates throughout the process, enhancing safety

• Periodic reviews ensure bioptic drivers are maintaining visual and driving proficiency

Netherlands - Takeaways for an Australian perspective

• Countries should draw on international cases to develop national frameworks

• A multidisciplinary approach should be used to holistically assess candidates

• Restrictions might be introduced based on functional capability and local conditions

Source: Bioptic Drivers Australia, Bioptic Driving USA, Williams OT, SME interviews

**Page 29** - Global cases and research safety

USA was the first country to regulate bioptics and rules vary by state

Case studies deep dives — USA

History

● Bioptic driving was introduced in the USA in the early 1970s1

● 45 states allow this technology to be used for driving if individuals meet certain requirements2; Utah, Iowa, Connecticut, Maine, and Washington DC do not allow bioptic driving, and Minnesota permits them on a case-by-case basis2

Requirements

● Bioptic driving rules vary across states and generate inconsistency2

● For most unrestricted licences, drivers typically require a 20/40 (6/12) VA with a and 120–140° total visual field at a minimum2

● If using bioptics, a VA of 20/40-20/70 (6/12-6/20) is typically required

● Some states do not allow their use to pass the required driving examination, despite them being permitted for driving

● VA of 20/200 (6/60) and up to 20/400 (3/60) can legally drive in some states (often with restrictions)

Impacts

● Decades ago in the USA it would have been significantly difficult for someone with mild to moderate vision loss to drive

● It is estimated that 8,000-10,000 Americans now use bioptics to drive3

● Although many of these drivers are on restricted licences, they are able to learn how to drive safely with appropriate training and the help of eye health assessors3

Safety

● Almost all (96%) of bioptic drivers are rated as safe to drive by evaluators, with no differences compared to the control group in: pedestrian detection, ratings for scanning, speed, gap judgments, braking, indicator use, or obeying signs/signals4

● Previous driving experience is a strong predictor of collision likelihood, however this is consistent with first time drivers overall (especially young drivers)5

Key learnings

● Consistency: A national framework should be introduced (e.g. in the Assessing Fitness to Drive guidelines) to increase consistency in candidate assessment and rules application

● Restrictions: Restrictions on drivers (e.g. daytime only or speed restrictions) should consider the local context and impacts on the driver and community

Refer to pages 32-33 for details on safety research

Notes: Sources: 1) Kelleher, Mehr & Hirsch, Motor Vehicle Operation by a Patient with Low Vision - Case Report, American Journal of Optometry and Archives of American Academy of Optometry (1971) 2) Chun, Cucuras & Jay Current

Perspectives of Bioptic Driving in Low Vision, Neuro-Ophthalmology (2016) 3) Burling-Phillips, Low Vision Drivers: The Ophthalmologist’s Role and Responsibility (2017) 4) Wood et al. Characteristics of On-Road Driving Performance of

Persons With Central Vision Loss Who Use Bioptic Telescopes, Invest Ophthalmol Vis Sci (2013) 5) Bowers et al. Detection of road hazards when viewing through a bioptic telescope, (n.d.)

**Page 30** - Global cases and research safety

Canada has a structured bioptic driving program with a focus on holistic evaluation and use of multidisciplinary teams

Case studies deep dives — Canada

History

● The INLB Bioptic Driving Program in Canada allows low vision patients to drive safely through the use of a multidisciplinary team approach1

● The SAAQ allows individuals using bioptics to show that they have developed the ‘necessary compensatory skills to drive safely’1

● The program consists of three stages: preliminary admission, evaluation and rehabilitation1

Requirements

● In Canada, bioptic use for driving is only permitted for those who live in Quebec, but is allowed to pass the vision test in Manitoba, Northwest Territories, and Nunavut2

● All individuals must meet the minimum VA acuity requirement of 20/501 to qualify for driving - even if they will use a bioptic whilst driving2

● There are a number of entry requirements for the INLB Bioptic Driving Program: a minimum VA of 20/200 (6/60) in the better eye, VF ≥ 100X80, stable visual condition and be able to attain a 20/50 (6/15) VA with ≤ 4X bioptic telescope power1

● Once drivers undergo the program and successfully pass, a recommendation report is provided and the individual must complete the SAAQ driving test to receive their licence1

Impacts

● The INLB program provides individuals with visual impairments the opportunity to increase their freedom of mobility1

● The use of a multidisciplinary team allows bioptic drivers to integrate this new-found ease of travel into all aspects of their lives

Safety

● Bioptic drivers in Canada are required to produce an annual visual report and undergo re-evaluation every 2 years to retain their driving licence1

Key learnings

● Clear rules: Assessment guidelines should clearly define when bioptics can be used to meet criteria

● Multidisciplinary assessment: A multidisciplinary approach should be used to properly assess candidates (e.g. ophthalmologists, optometrics, occupational therapists, etc.)

● Specific training: A structured bioptic training approach should be used to assess candidates throughout the process, enhancing safety (Canada employs a 4-month pre-driving training on a simulator plus a 12 month in-car driving program1)

● Periodic reviews: Reviews are in place to ensure bioptic drivers are maintaining visual and driving proficiency

Notes: Sources: 1) Institut Nazareth et Louis-Braille, Bioptic Driving Program: Multidisciplinary rehab allowing low vision patients to drive safely (2017) 2) Chun, Cucuras & Jay

Current Perspectives of Bioptic Driving in Low Vision, Neuro-Ophthalmology (2016)

**Page 31** - Global cases and research safety

The Netherlands recently regulated bioptic driving and focus on multidisciplinary and inclusive assessments

Case studies deep dives — Netherlands

History

● Bioptic driving has been legal since 2009 in the Netherlands1

● This legalisation occurred as a result of a 2006 demonstration project showing favourable patient outcomes after undergoing a bioptic training program2

● This project was based on the range of bioptic driving programs in the USA and adapted accordingly to fit into the Netherlands’ driving training and assessment practices3

Requirements

● Based on the favourable results of the 2006 project, bioptic use was legalised in

the Netherlands for patients with a VA between 20/40 and 20/160 (6/12 and 6/48)2

● Additional and specific requirements were also set for night time driving2

Impacts

● The pilot project demonstrated that some drivers with impaired vision are able to be

trained to drive safely and proficiently using a bioptic telescope on the roads and

conditions that are common to a European country3

● As the first bioptic driving project in Europe, there is the potential that this program

and approach to formalisation could be used in other countries with similar driving

conditions and requirements3

Safety

● The 2006 project showed that a number (25%) of people with moderately reduced

visual acuity could be trained to be a proficient and safe driver using a bioptic

telescope3

● Bioptic driving in the Netherlands has largely been restricted to the day time

● Studies have shown that some low vision drivers (33%) can drive safely at night

with bioptics1

● A practical fitness to drive test can be used as an accurate predictor of safety for

nighttime driving1

Key learnings

● Case study: Countries should drawn on international cases to elaborate

national frameworks

● Multidisciplinary assessment: A multidisciplinary approach should be used to

properly assess candidates

○ Research highlight the importance of assessing individuals as a whole (e.g.

optical, motor and behavioral issues, driving experience)4

○ There should be a focus on an individualised approach to assessment as it is not

possible to rely on self-reported driving abilities or VA assessments only4

● Restrictions: Restrictions might be introduced based on functional capability

and local conditions

● Public awareness: A uniform public information policy was utilised as a key

enabler of bioptic driving in the Netherlands4

Notes: Sources: 1) van Damme & Melis-Dankers, A study of bioptic driving at night (n.d.) 2) Chun, Cucuras & Jay, Current Perspectives of Bioptic Driving in Low Vision,

Neuro-Ophthalmology (2016) 3) Kooijman et al. The Introduction of Bioptic Driving in The Netherlands, Visual Impairment Research (2008) 4) Melis-Dankers et al. A

Demonstration Project on Driving with Reduced Visual Acuity and a Bioptic Telescope System in the Netherlands, Visual Impairment Research (2008)

**Page 32** - Global cases and research safety

Authorities that commissioned bioptic driving research continue to permit its use; research shows its comparable safety

Research on bioptic driving safety

Authorities requesting initial research permitted their use following the release of the study findings (e.g. California)

• The Assessing Fitness to Drive (AFTD) guidelines (par. 10.2.7) mentions that ‘there is little information on the safety or otherwise of drivers’ for bioptic driving

• Older research on bioptic driving showed higher collision rates for bioptic drivers than the population average, e.g.:

○ 1.9x higher rates in California1, according to a 1983 study

○ 1.34x in Texas2, according to a 1988 study

○ 1.2x in Illinois3, according to a 1990 study

This slightly higher accident rate has been taken by some to mean that bioptic driving is not safe and should not be permitted. However, there are many groups with higher accident rates than the average population and bioptic driving frameworks in each of these states are still active to this day.

• Other articles describe additional challenges with bioptics safety, e.g. potential hazards4, ring scotoma (e.g. seeing magnified image projected over central view)4-5, as well as concerns that patients may use bioptics only to pass tests but not while driving4

• Experts recognise that some of these studies are dated, have limitations in research design (including age matching as age is a key risk factor) and did not involve training programs with technological advances6

Recent research shows the comparable safety levels of bioptics users

• Recent studies considering modern technology and countries that recently regulated bioptics indicate comparable safety for bioptic drivers when appropriate training is completed, e.g.:

○ Bioptic drivers have, at maximum, comparable performance to average drivers7

○ At a minimum, bioptic drivers have similar collision rates to many groups with higher collision rates than the average of the population (e.g. other physical and cognitive medical conditions, and younger drivers) that are permitted to drive:

- 1.9x for hearing impaired5

- 18x for that of 16y/o drivers3

○ Factors such as age and driving experience are more significant to predict accidents, both for general and bioptic driving populations8-9

○ Bioptic drivers demonstrate proficient on-road skills when licenced through a bioptic driving program7

○ Driving with bioptic telescopes doesn’t increase citation /accident risk when a bioptic training program is completed8

○ The fellow eye is able to compensate for ring scotoma, preserving peripheral vision10

○ The majority of bioptic users continue to employ the device after obtaining their licences11-12

Experts recognise that bioptic driving should be allowed

“Thus, one would not like to withhold driving privileges unless absolutely necessary. Interpretation of the Americans with Disabilities Act prohibits unjustified limiting of a driving licence as discrimination against the disabled.”

Dr. Eli Peli

Professor of Ophthalmology at Harvard University13

“Drivers with central vision loss who are licenced to drive through a bioptic driving program can display proficient on-road driving skills. This raises questions regarding the validity of denying such drivers a licence without the opportunity to train with a bioptic telescope and undergo on-road evaluation.”

Dr. Joanne Wood

Professor at QUT School of Optometry & Vision Science7

Notes: 1) Janke, Accident rates of drivers with bioptic telescopic lenses, J Safety Res (1983) 2) Lippmann et al. Bioptic telescopic spectacles and driving performance: A study in Texas, J Vis Impair Blind (1988) 3) Taylor, Telescopic

spectacles for driving: user data satisfaction, preferences and effects in vocational, educational and personal tasks: a study in Illinois, J Vis Rehab (1990). 4) Fonda, Bioptic telescopic spectacle is a hazard for operating a motor

vehicle, Arch Ophthalmol (1983). 5) Levin et al. Driving with a bioptic telescope: an interdisciplinary approach, Am J Optom Physiol Opt (1975). 6) Owsley, Driving with bioptic telescopes: organizing a research agenda, Optom

Vis Sci (2012). 7) Wood et al. Characteristics of on-road driving performance of persons with central vision loss who use bioptic telescopes, Invest Ophthalmol (2013). 8) Vincent et al. Driving Performance Among Bioptic

Telescope Users with Low Vision Two Years After Obtaining Their Driver's License, Assistive Technology (2012). 9) Dougherty et al. Previous driving experience but not vision, is associated with motor vehicle collision rate in

bioptic drivers, Invest Ophthalmol (2015). 10) Bowers et al. Detection of road hazards when viewing through a bioptic telescope, Optom Vis Sci. (2018) 11) Bowers et al. Bioptic Telescopes Meet the Needs of Drivers with

Moderate Visual Acuity Loss, Invest Ophthalmol Vis Sci. (2005). 12) Owsley et al. Visually impaired drivers who use bioptic telescopes: self-assessed driving skills and agreement with on-road driving evaluation, Invest

Ophthalmol (2014). 13) Interview with Dr. Eli Peli, based on Driving with low vision: who, where, when, and why. In: Albert and Jakobiec's Principles and Practice of Ophthalmology, manuscript submitted for publication.

Research on bioptic driving safety

**Page 33** - Global cases and research safety

The detailed findings from recent research show comparable safety of bioptic drivers and suggest their inclusion

Research on bioptic driving safety — detailed findings

For a comprehensive review of literature by a medical expert, please refer to Harvard University’s Prof. Eli Peli’s book: “Driving with Low Vision: Who, Where, When and Why” (2008)1

Table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Topic | Previous research | Findings (initial dissent on bioptic driving) | More recent research | Findings (towards inclusion of bioptic drivers) |
| Collision rates | ● Janke (1983) and Clarke(1996) | ● 1.9x higher collision rates in California, biopticdrivers added a total of 3 collisions to the 1.1million collisions per year● “When corrected for age, gender and invalidlicenses, the difference was statistically significantin Clarke but not Janke”1 | ● Ivers et al. (1999) | ● Rate of collisions in hearing impaired were similar tothose patients with reduced acuity and higher than therate previously reported for bioptic drivers |
|  | ● Lippmann et al. (1988) | ● 1.34x higher collision rates in Texas | ● Vincent et al. (2012) | The use of bioptics does not increase risk of accidentsand offenses when a bioptic training program iscompleted |
|  | ● Taylor (1990) | ● 1.2x higher collision rates in Illinois | ● Dougherty et al. (2015) | ● Bioptic drivers have a mean rate of 0.13 collisions/yr● Previously experienced drivers a lower rate of 0.077 andnovice drivers have a rate of 0.20 |
| Bioptic safety | ● Fonda (1983) | ● Potential hazards with bioptics while driver islooking through telescope● ‘Blind’ areas created in the peripheral field | ● Wood et al. (2013) | ● Bioptic drivers demonstrate proficient on-road skills whenlicenced through a bioptic driving program● Bioptic drivers have comparable performance to average● Jose and Ousley (1984) drivers |
|  | ● Jose and Ousley (1984) | ● Bioptics should be used no more than 10% of thedriving time |  |  |
| Ring Scotoma | ● Fonda (1983) and Levin etal. (1975) | ● Ring scotoma occurs when using bioptics● E.g. seeing magnified image projected overcentral view | ● Bowers et al. (2018) | ● The fellow eye is able to compensate for ring scotoma● Peripheral vision is preserved |
| Bioptic use | ● Fonda (1983) | ● Patients may use bioptics only to pass tests but not while driving | ● Bowers et al. (2005) andOwsley et al. (2014) | ● The majority of bioptic users continue to employ biopticdevices after obtaining their licence |
| Risk factors | ● Levin et al. (1975) | ● Induced parallax, reduced reaction time, restrictedvisual field with magnification, and difficult usewith mirrors | ● Vincent et al. (2012) andDougherty et al. (2015) | ● Age and driving experience are more significant to predictaccidents● Both for general and bioptic driving populations |

Note on Collision rates: ● “This slightly higher accident rate has been taken by some to mean that bioptic driving is not safe and should not be permitted. However, there are many groups with higher accident rates than the average population.”1

● California continues to allow, and never revoked, bioptic driving

Notes: 1) Interview with Dr. Eli Peli, Professor of Ophthalmology at Harvard University, based on Peli E., Driving with low vision: who, where, when, and why. In: Albert and Jakobiec,

Principles and Practice of Ophthalmology, Elsevier (2008)

**Page 34 -** title page: 5. Key elements for an Australian framework

A formalised Australian bioptic driving framework should build on global cases and use a multidisciplinary and comprehensive approach to assess candidates

**Page 35** - Key elements for an Australian framework

Based on global cases, a bioptic driving framework should include specific training and a multidisciplinary assessment

Potential Australian bioptic driving framework (1/2)

Engage with key govt. stakeholders

● Start building support for a bioptic driving framework

● Discuss govt. funding for bioptics devices

● Start developing revised AFTD bioptics standards (engage with NTC and Austroads)

Multidisciplinary input into framework development

● Consult with key professional bodies, individuals

● Engage with advocacy bodies and disability communities

Public awareness campaign

● Develop targeted materials for identified communities

● Target individuals for the delivery of professional workshops and awareness presentations

Formalisation of the Australian Bioptic Driving Framework

● Development of a standard for bioptic driving in the AFTD guidelines

● Used and integrated into appropriate frameworks by all jurisdictions

● Comprehensive guidance provided to relevant state and territory licencing authorities

Initial eligibility assessment

● Baseline eligibility requirements should be passed, in line with international best practice and standards

● An evaluation of any other factors that may impact driving ability to be conducted

Further detail overleaf

Pre-driving training

● Candidates will go through an 8 week program prior to in-car driving

● Topics to include risks and safety in addition to computer simulation driving training with bioptics

Further detail overleaf

Practical training

● 10-30 hours of practical driving with qualified instructor

● Training to be held over a range of driving and weather conditions

Further detail overleaf

Final assessment and restrictions

● Final driving assessment by qualified driving instructor

● Restrictions and compensatory supports determined on a case-by-case basis

Further detail overleaf

Ongoing consultation and monitoring

● Defensive driving course

● Annual visual function and practical driving testing for high risk clients

● Development of bioptic driving community

Further detail overleaf

The Australian Bioptic Driving Framework should follow these key principles:

1. Clear, concise and informative language to define bioptic driving and eligibility requirements

2. Ability for consistent legal application across all States and Territories

3. Inclusion of a range of healthcare professionals in the initial driver eligibility assessment and during ongoing monitoring

4. Appropriate case-by-case evaluation of driving restrictions and compensatory supports

5. Empowering training and communication for bioptic drivers

**Page 36** - Key elements for an Australian framework

A 5-step approach to assess and licentiate candidates for bioptic driving is proposed based on global examples

Potential Australian bioptic driving framework (2/2)

Step one: Initial eligibility assessment

• Completion of initial test to establish functional vision baseline

• Identification of potential improvements by a registered eye health professional

• Initial eligibility assessment considering appropriate standards, for example:

○ Visual acuity of 6/12 or better using bioptic devices

○ Visual field of less than 110 degrees but greater or equal to 90 degrees

○ Contrast sensitivity and colour differentiation testing

Step two: Pre-driving training

• Completion of a pre-driving training program (e.g. 8 weeks)

• Training to potentially include the following topics:

○ Introduction to the Australian Bioptic Driving Framework and driver responsibilities

○ Techniques on low vision driving

○ Risks of bioptic driving - how you can minimise and mitigate these risks

○ How bioptics work in practice

- computer driving simulation training

○ Candidates are taught commentary driving and encouraged to practice at home

Step three: Practical training

• In-car practical training (e.g. 10-30 hours) with a qualified bioptic driving instructor

• Integration into state and territory mainstream driving programs

• The training sessions can potentially be held in a range of driving/weather conditions:

○ Suburban streets

○ Highways

○ Times of reduced visibility (rain, fog, nighttime)

Step four: Final assessment and restrictions

• Final driving assessment by qualified driving instructor

• Written report provided to eye health professional outlining potential required restrictions and compensatory supports

• Final determination by a multidisciplinary team on a case-by-case basis and as agreed with candidate

• These may include: daytime driving only, reduced speed limits, maximum radius of travel by driving from candidate’s home, colour tints to improve glare recovery and/or colour differentiation

• A written letter to be provided to relevant State or Territory driving authority for conditional licence

Step five: Ongoing consultation and monitoring

• Annual visual function and practical driving tests for higher risk clients (first time, young and older drivers and those with degenerative eye conditions)

• Potentially include the completion of a defensive driving course (e.g. within the 1st year of obtaining a provisional licence)

• Drivers to engage with the bioptic community for peer support to:

○ share experiences

○ learn from each other on overcoming barriers to driving

○ implement safe driving practices

Source: Dicsussions wtih BDA, SME interviews, international case studies.

**Page 37 - Appendix title page**

**Page 38** - Appendix: We interviewed experts from Australia and abroad

List of experts interviewed

Dr Sharon Oberstein

Optometrist & Deputy Clinic

Director, UNSW Optometry

Clinic.

Sharon has worked in private optometric practice and university low vision clinics in South Africa, the United Kingdom and Australia. Her research area concerns driving with central visual impairment, the topic of her PhD.

Bradley Williams

Director & Primary

Occupational Therapist,

Williams OT

Brad provides bioptic driver assessments and training in the Adelaide region of South Australia, opening Williams OT in 2011. Prior to this, he managed Occupational Therapy driver assessments at the Repatriation General Hospital from 2008 to 2015.

Elizabeth Beals

President, Albinism Fellowship

of Australia

Elizabeth has OCA and Nystagmus was diagnosed withAlbinism at the age of 40. Liz is passionate about empowering persons with Albinism and also creating an accurate and positive

perspective of Albinism in the media.

Chuck Huss

C.O.M.S.

Driver Rehabilitation Specialist,

State of West Virginia

Chuck Huss is a Certified Orientation and Mobility Specialist and Driver Rehabilitation Specialist in the United States. Chuck has completed significant research on the effectiveness and use of

bioptics for driving.

Eli Peli, MSc, OD

Professor of Ophthalmology,

Harvard Medical School

Prof. Eli Peli specialises in AMD, Mobility Enhancement and Vision Rehabilitation at Harvard. He is also the Co-Director of Mobility Enhancement & Vision Rehabilitation Center of Excellence.

**Page 39 to 41** - list of references

Our findings are supported by the review of over 60 articles published in scientific journals and other research materials

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