



AUSTRALIAN COLLEGE OF
OPTOMETRY

CLINICAL SERVICES • EDUCATION • RESEARCH

Crash!

When vision impacts driving

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Lecture Objectives

1. Outline the impact of prevalent eye diseases on driving performance
2. Describe the reasons why patients with vision loss make the final decision to stop driving
3. Advise patients on when and how to hang up their car keys



Road traffic injuries

cause 1.25 million deaths
per year worldwide;

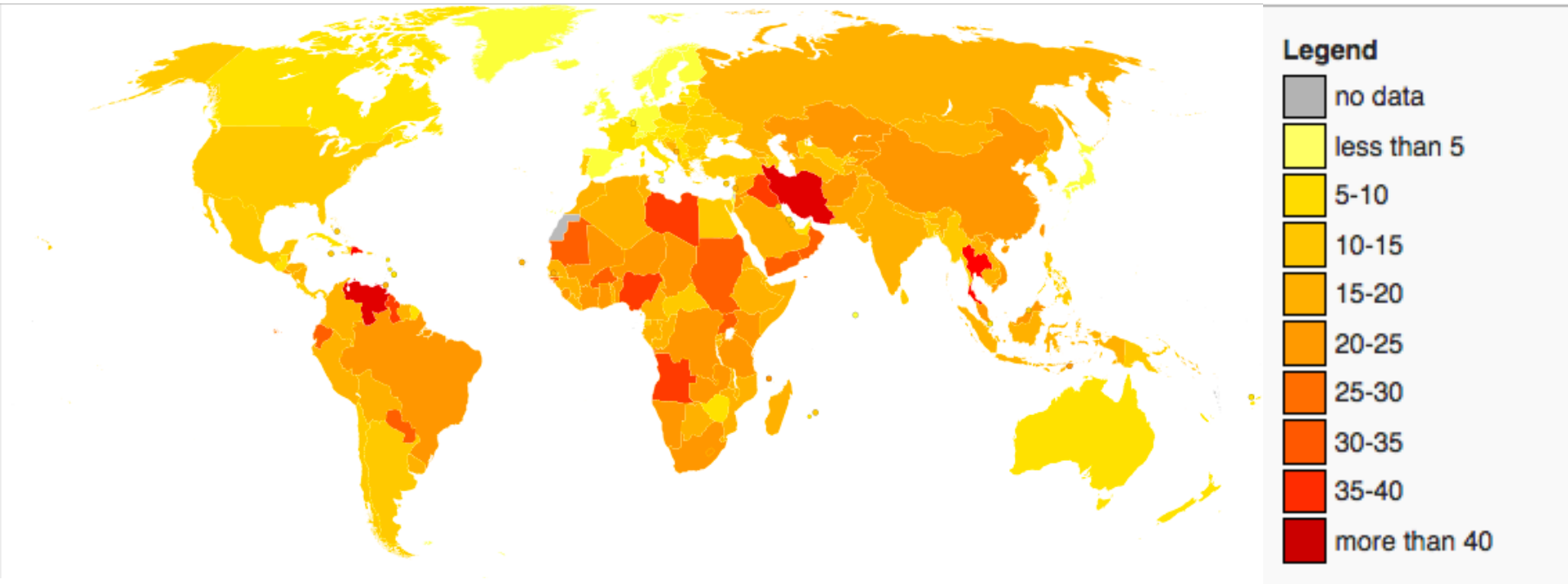
= one person every 25 s.

Tens of millions injured or
disabled.

Children, pedestrians,
cyclists and older people
are among the most
vulnerable of road users.



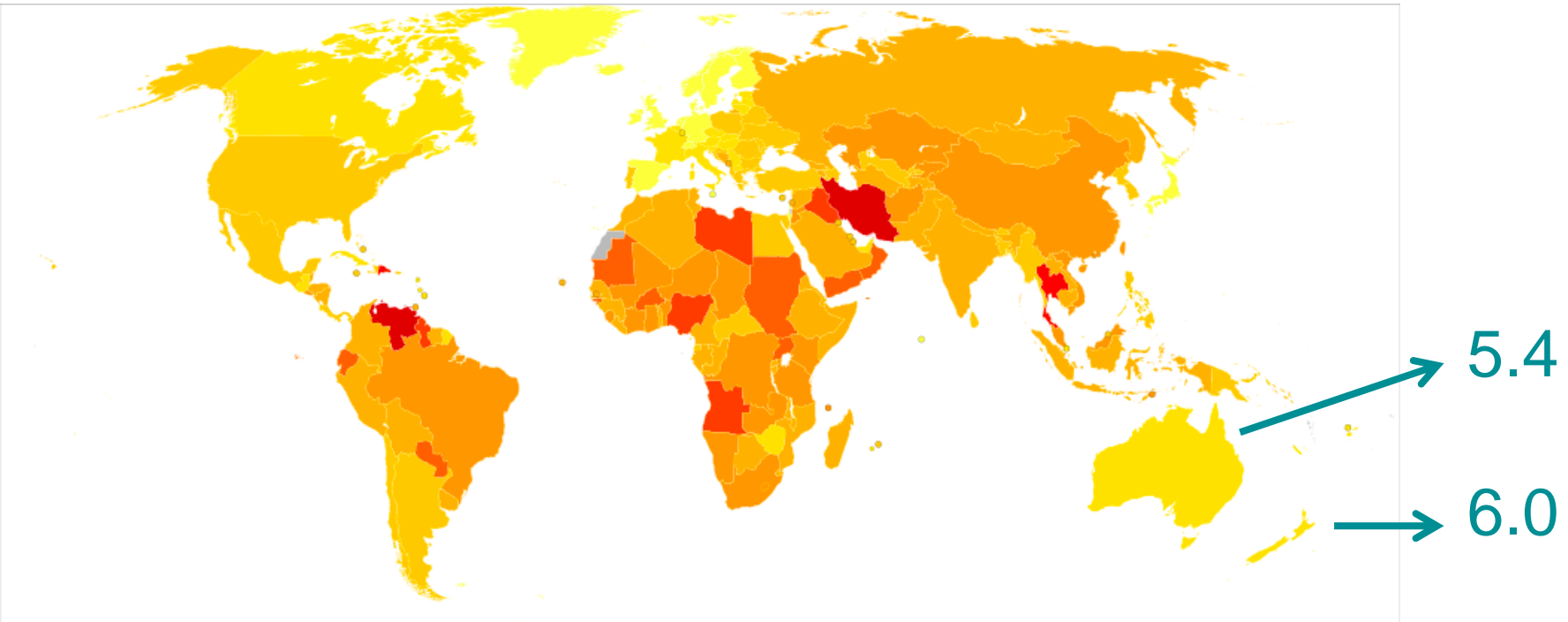
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Annual death rates from road traffic accidents per 100,000 inhabitants, by country

- Low income countries have the highest rates

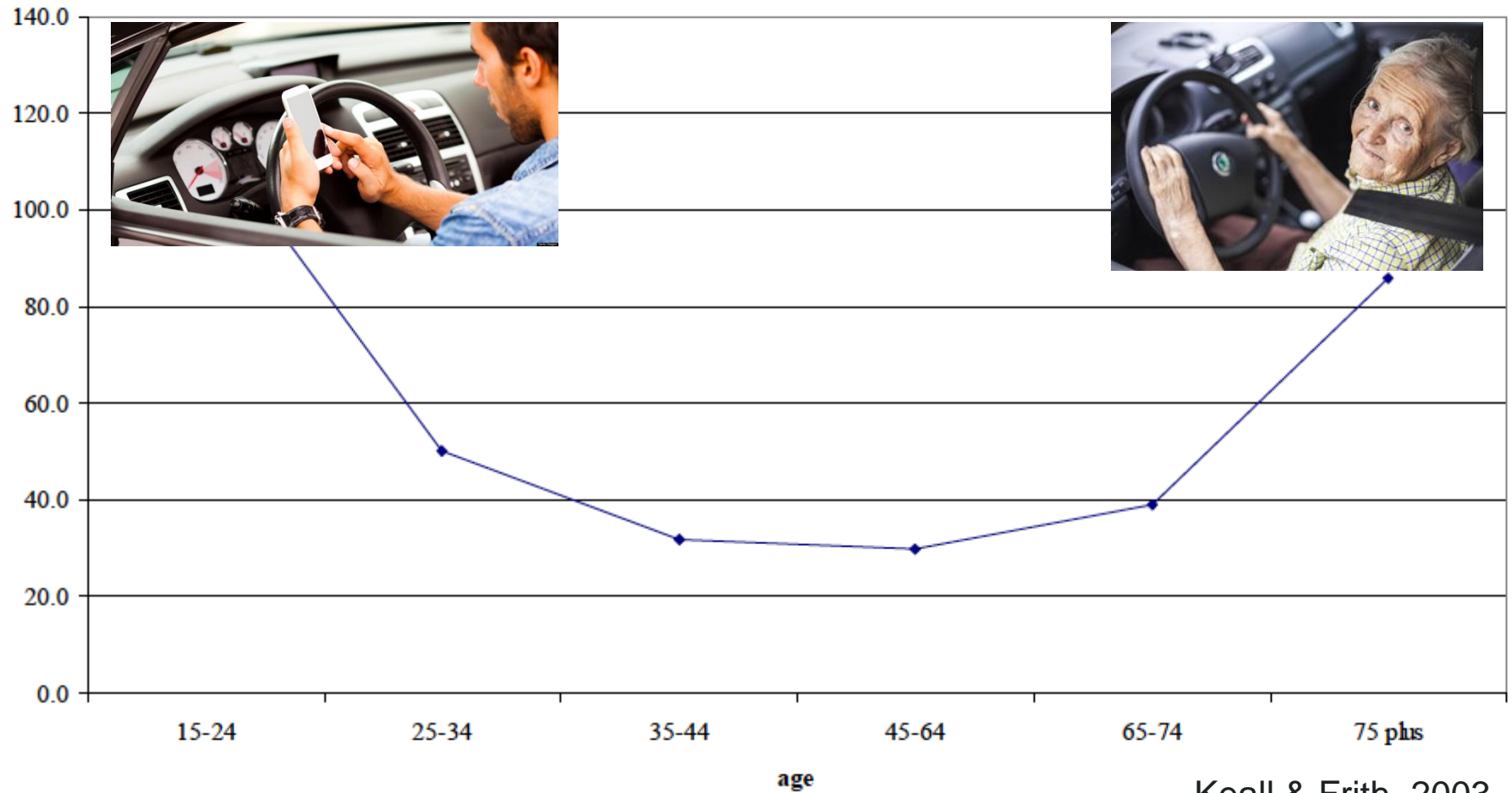
WHO 2012



Death rates from road traffic accidents by country, per 100,000 inhabitants

WHO 2012

Figure 1: Risk of involvement in injury crashes per 100 million km driven



Keall & Frith, 2003

- Older drivers comprise the fastest growing segment of the driving population in Aus. & NZ
- They will drive at older ages and more kms
- For older drivers, physiological changes and risk of disease associated with increasing age, such as decline in vision and reaction time, increase the risk of a crash
- Risk of being killed or suffering serious injury is 2 to 5 times greater than younger person because they are more fragile

Holland 2002; Meuleners et al 2006



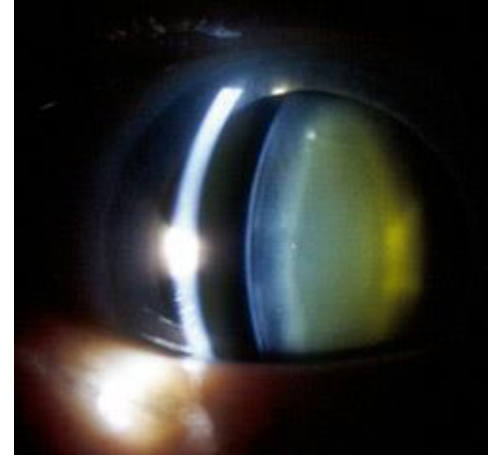


Cataract

Self-report:

- Increased driving difficulties
- Drive shorter distances
- Less often
- Avoid driving in rain, peak hour and night

(Fraser et al., BMC Ophthalmol, 2013)

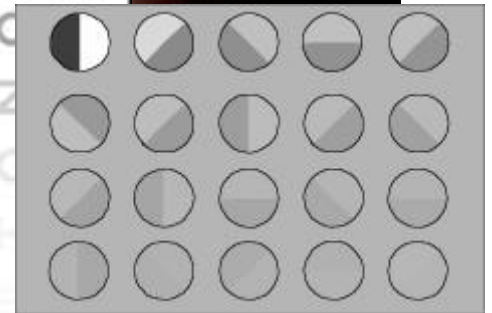
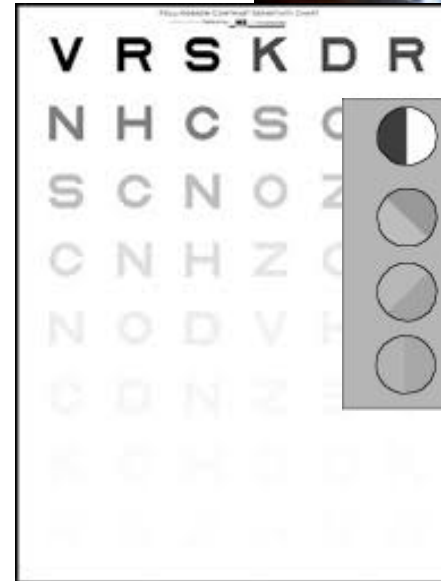
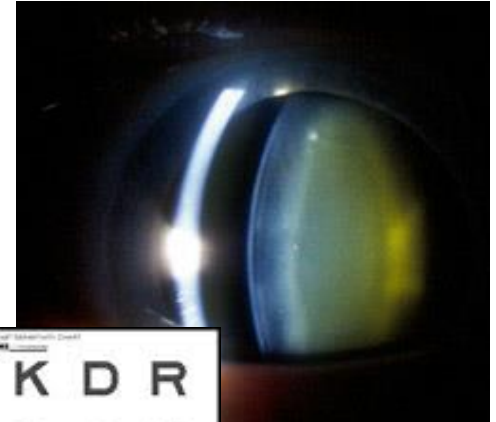


Cataract

Motor vehicle collisions (MVCs):

- 2.5 times more at-faults than age-matched controls
- 8 times more likely to have severe loss of CS

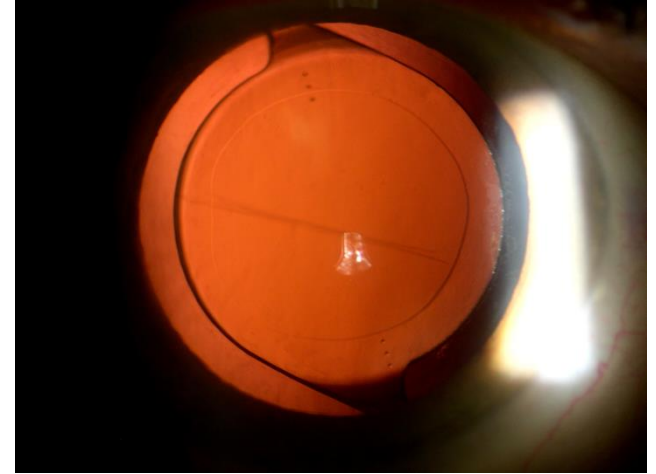
(Owsley et al., Arch Ophthalmol, 2001)



Cataract

Cataract surgery:

- 88% reduction of driving difficulties
- 13% reduction in MVC risk for first eye



(Subzwari et al., Inj Prev, 2008; Meuleners et al., Ophthalmic Epidemiol, 2012)

Cataract

What we don't know:

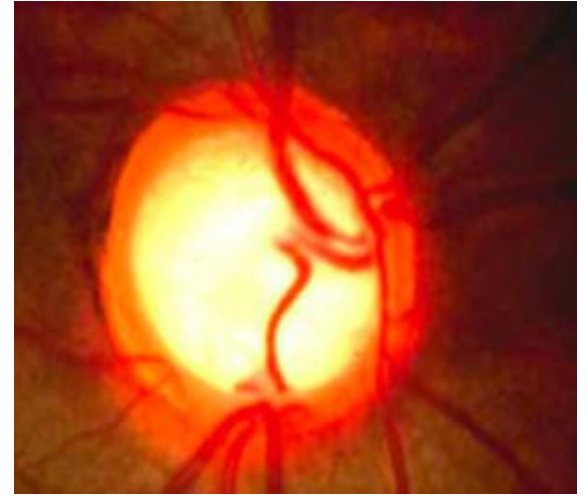
- Impact of second eye surgery
- Impact of self-regulation of driving
- Who should be prioritised for surgery?



Glaucoma

Self-report:

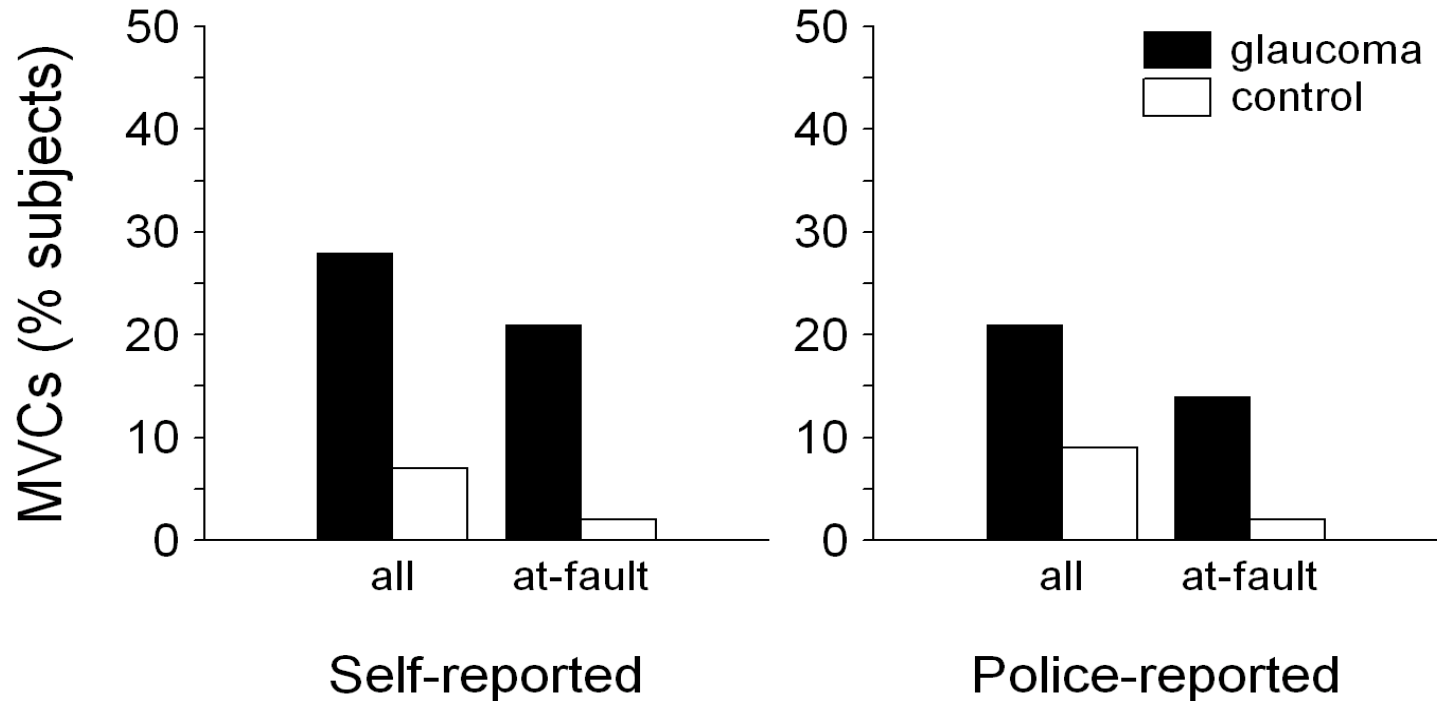
- Problems with glare, night driving, tasks requiring peripheral vision
- Avoidance of challenging situations
- Stay closer to home
- 3 times more likely to cease driving



(McGwini et al., Invest Ophthalmol Vis Sci, 2004; Ramulu et al., Ophthalmol, 2009)

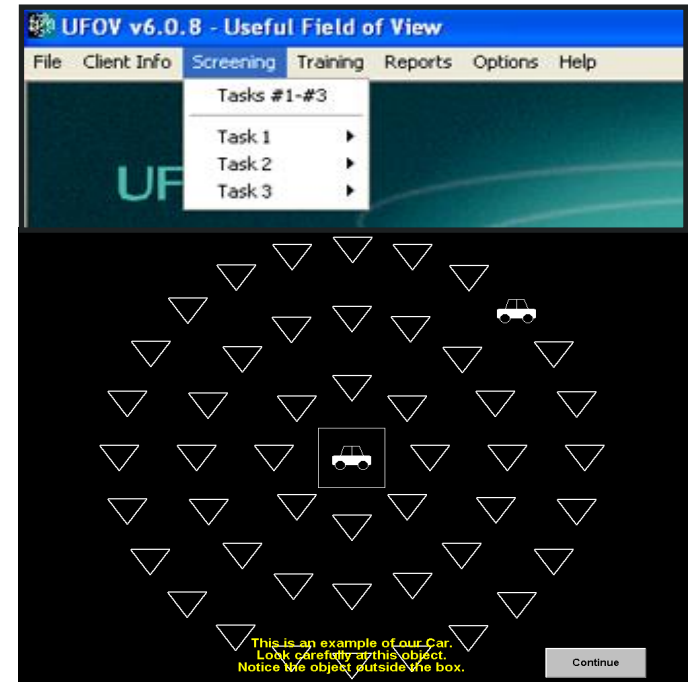
MVCs:

- 3 to 6 times more likely



MVCs:

- Risk ↑ severe visual field loss in worse eye ($MD \leq -10$ dB)
- Risk ↑ reduced UFOV

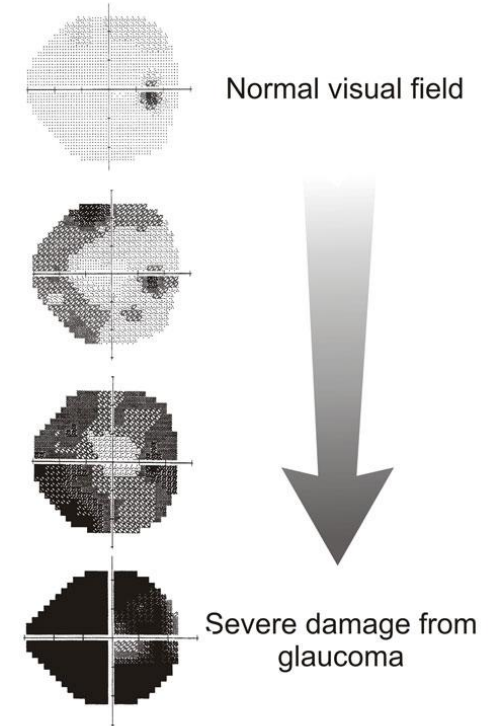


(Haymes et al., Invest Ophthalmol Vis Sci, 2007)

Glaucoma

Visual field loss is the important factor:

- More important than VA and CS
- Severe glaucomatous visual field loss doubles risk for at-fault MVCs



(McGwin et al., J Glauc, 2015; Kwon et al., Ophthalmol, 2016)

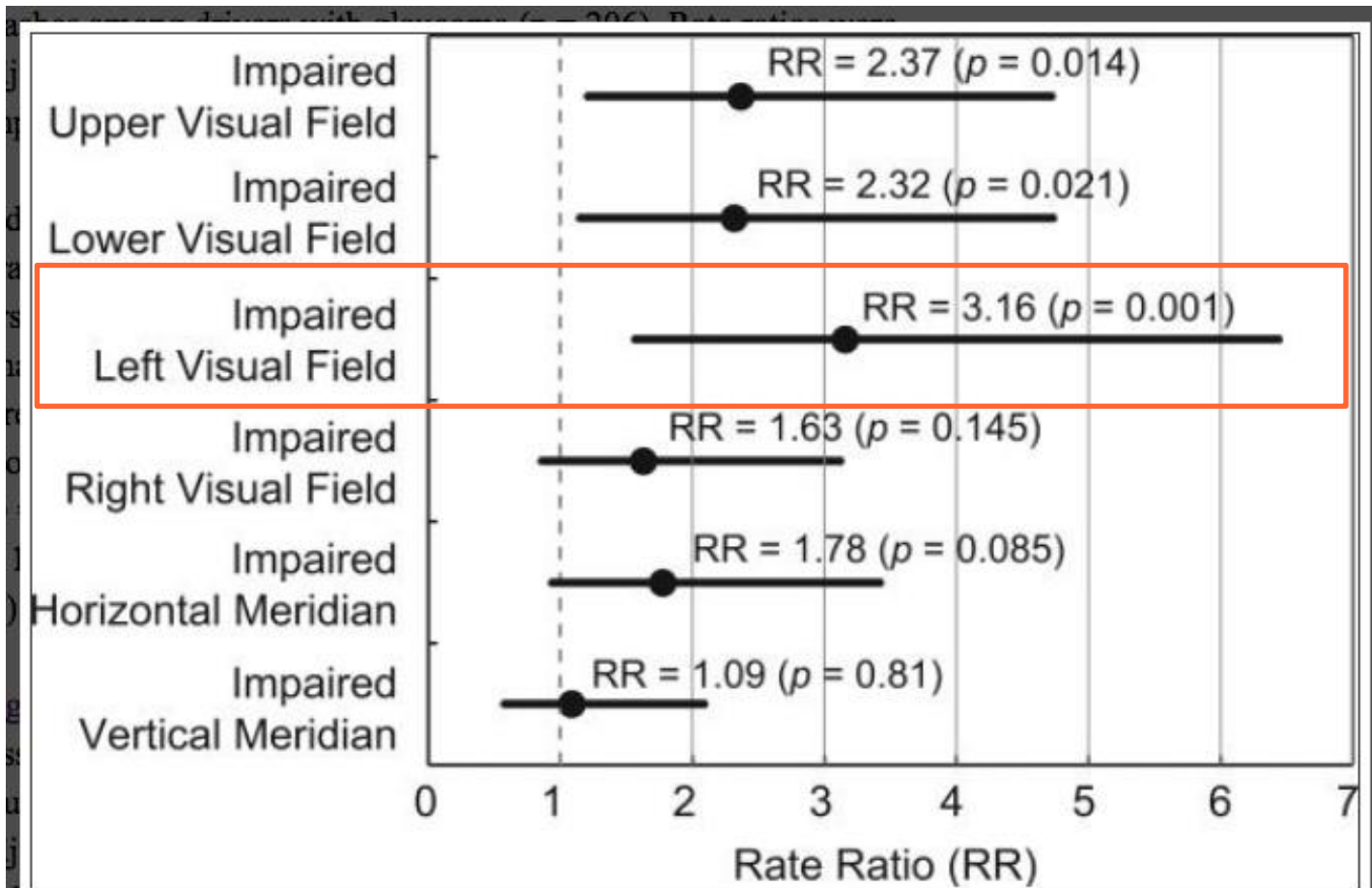


Figure. Binocular visual field impairment and rates of at-fault crashes among 206 drivers with glaucoma. (Kwon et al., Ophthalmol, 2016)

Driving performance:

- Near-crash rates 10 times higher than actual crash rates
- Haymes et al., Invest Ophthalmol Vis Sci, 2008
- 20 patients with glaucoma
 - mean age 68 y (SD, 7)
 - mean MD better eye -1.7 dB (SD, 2.2)
- 20 age-matched healthy controls
 - mean age 67 y (SD, 7)
- Current, licensed drivers



- On-Road Driving Test
- Standardised 10 km route
- Residential and business districts, Halifax
- Dual brake control vehicle
- Professional driving instructor (masked)
- Certified Driver Rehabilitation Specialist (masked)

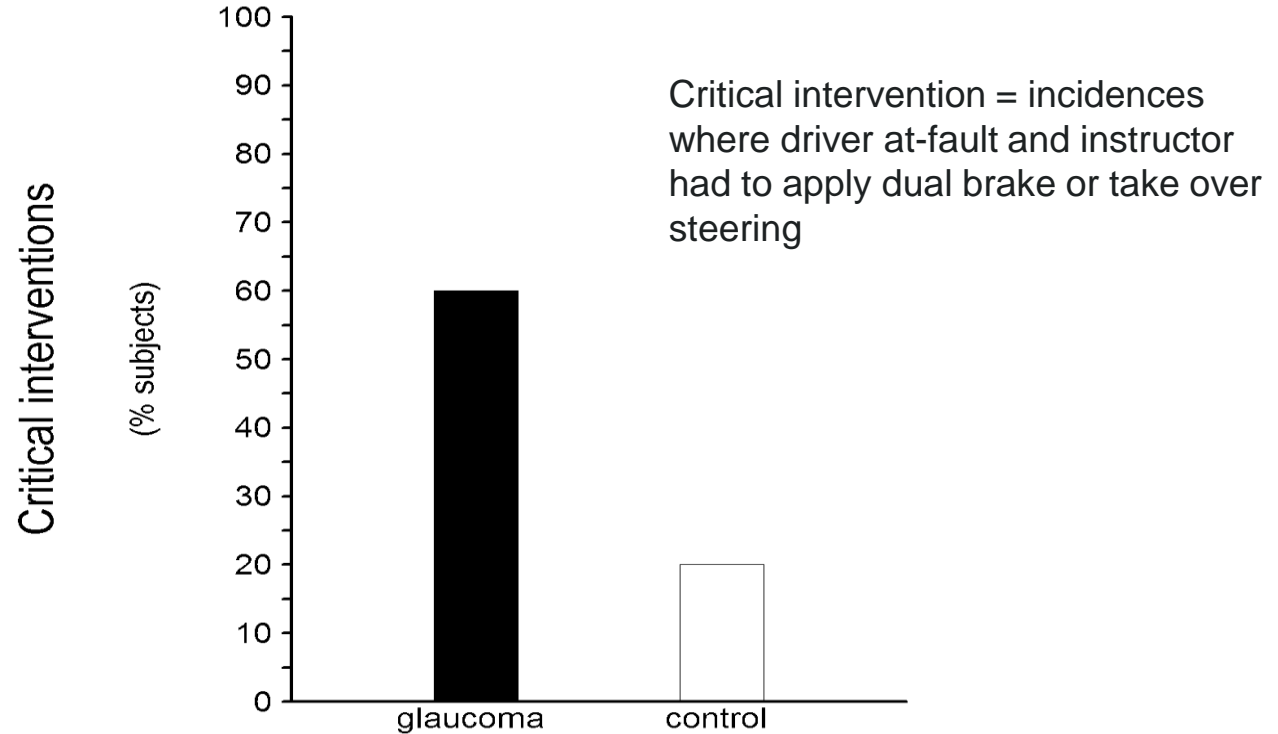




Driving Skill	Glaucoma n = 20	Control n = 20	P
Total satisfactory maneuvers (no. out of 55)			▼
median (range)	50 (41 to 54)	51 (44 to 53)	0.65

**No significant difference in overall skills or
rating of performance**

Critical interventions



Odds Ratio = 6.0 (95% CI, 1.5 to 24.7)

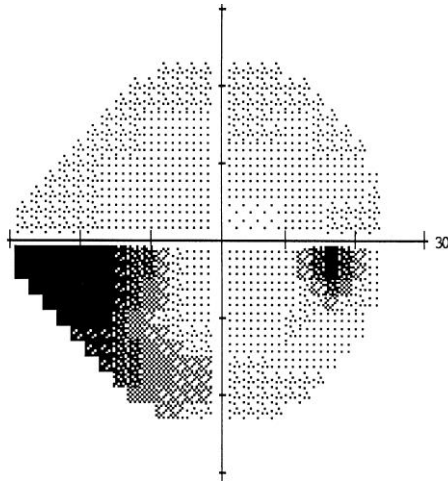
Critical interventions

**8 out of 12 glaucoma cases (67%), intervention
due to failure to see and yield to a pedestrian**




Critical interventions

Among the glaucoma group, HFA MD ≤ -4 dB in the worse eye was associated with critical interventions (OR = 8.3)



Glaucoma

- 20% have progressive field loss even on appropriate treatment
 - Half of those with glaucoma are unaware that they have it
 - Possible to lose a lot of field without realising
- ➔ Unlikely to self-regulate driving early



GLAUCOMA
**“The Sneak
Thief of
Sight”**

(Weih et al., Ophthalmol, 2001)



Glaucoma

What we don't know:

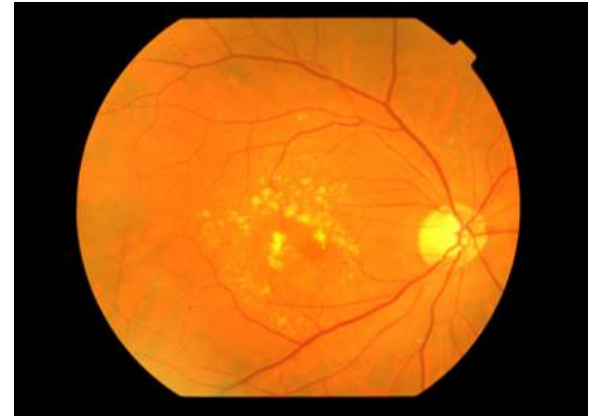
- Which aspects of the visual field are most important
- Role of eye movements and scanning



Age-Related Macular Degeneration

Self-report:

- Avoidance of challenging situations
- Difficulties with night driving
associated with reductions in rod
mediated / scotopic sensitivity
- May cease driving



(Sengupta et al., Ophthalmol, 2014; Scilley et al., Ophthalmol, 2002)

Age-Related Macular Degeneration

MVCs:

- Intermediate AMD lower risk than controls!
 - Perhaps self-regulate to avoid challenges and exercise greater caution
 - Early and advanced AMD no significant difference to controls!
 - Early may not self-regulate
 - Advanced too few in study
- (Mc Gwin et al., Br J Ophthalmol, 2013)

Age-Related Macular Degeneration

Driving performance:

- Slower speeds
- Poor lane control
- Poor hazard detection rates



(Szlyk et al., Hum Factors, 1995; Bronstad et al., PLoS One 2015)

Age-Related Macular Degeneration

What we don't know:

- A lot! Few studies
 - Loss is more obvious and more of a problem and may stop driving
 - Important to investigate because will be more prevalent, with more tx options may retain better vision and try to continue driving



Stopping Driving: What is the Tipping Point?

- To stop driving is not an easy decision
- Associated with:
 - loss of independence and personal identity
 - reduced participation
 - depression
 - decreased quality of life
 - mortality



Stopping Driving: What is the Tipping Point?



- Little known; some may drive longer than is safe and others restrict too early
- At some point, older persons with vision impairment may need to consider whether or not to stop driving
- When and how not clear because many complex and inter-related issues influencing the decision

Stopping Driving: What is the Tipping Point?

Blue Mountains Eye Study (Gilhotra et al., Clin Exp Ophthalmol, 2001)

- Older persons and women more likely to have stopped driving
- After adjustment for age and sex, vision impairment, hearing impairment, chronic medical conditions and benzodiazepine use associated with stopping

Stopping Driving: What is the Tipping Point?

Salisbury Eye Evaluation Project (Ramulu et al., Ophthalmol, 2009;
Keay et al., Invest Ophthalmol Vis Sci, 2009)

- Glaucoma associated with driving cessation
- Poor CS and cognitive function
- Note: VA is seemingly not best indicator of driving performance or driving cessation

Stopping Driving: What is the Tipping Point?

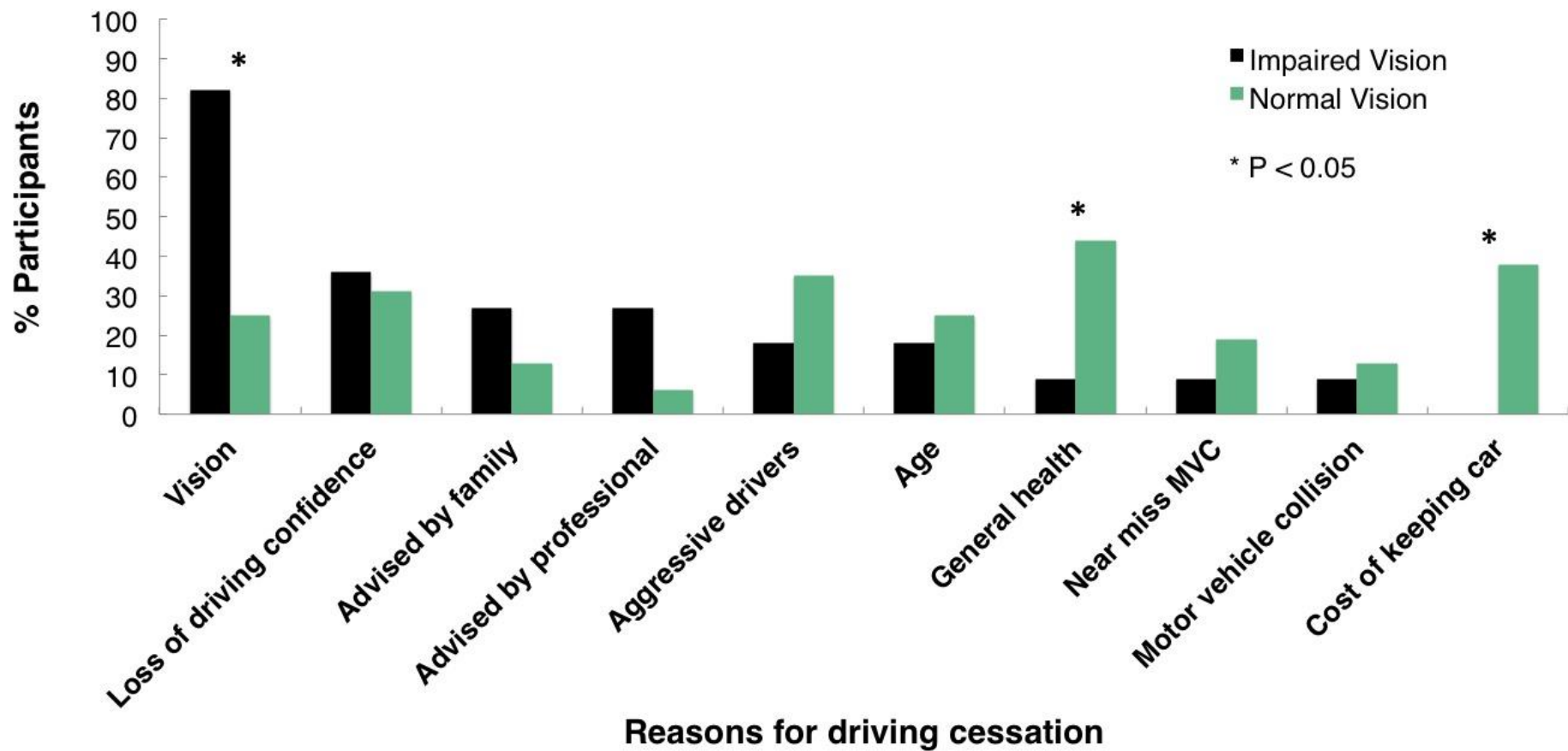
- Bentley, Wood, Keefe,
Charlton, Ly, Jackson (2015)
- Telephone survey of older persons who retired from driving in the past 5 years
 - Vision loss (n = 11 with AMD) vs. normal vision (n = 16)



Stopping Driving: What is the Tipping Point?

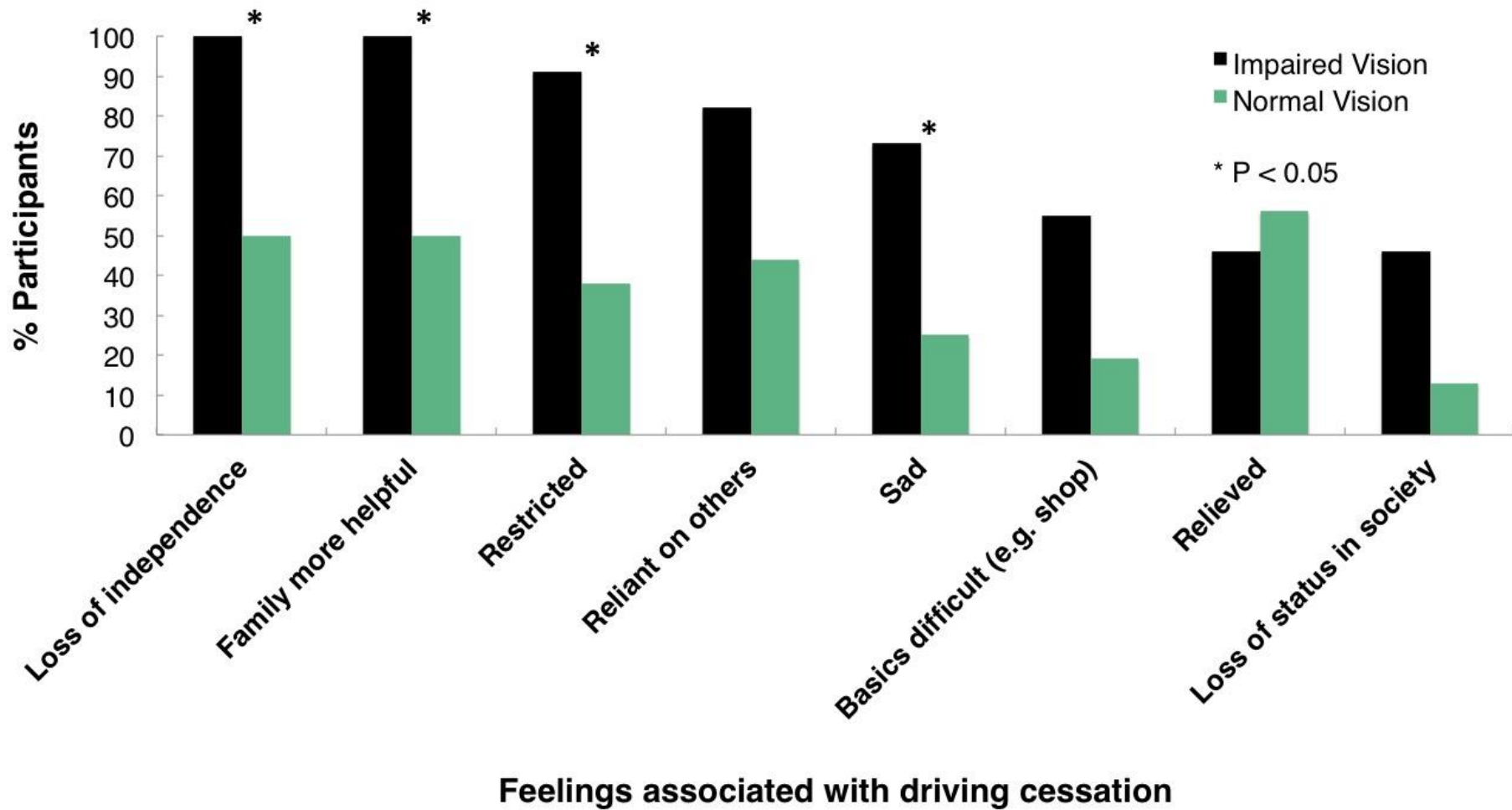
- Why they stopped driving
- How they arrived at the decision
- Impact this had on them
- How they adapted to it
- Advice for others

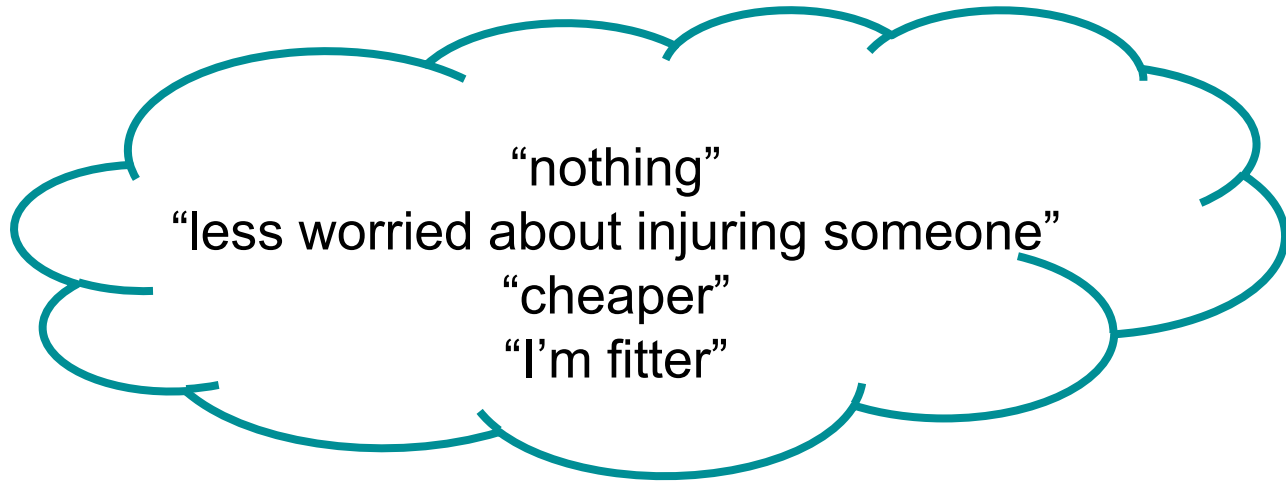






Strategies for getting about	Impaired Vision	Normal Vision
Someone else drives	82%	44%
Walk	55%	75%
Public transport	36%	56%
Taxi	46%	50%
Volunteer service	27%	0%





What are the positives of not driving?

How satisfied are you with how you get around now?

- 91% of those with vision impairment and 100% of those with normal vision said “somewhat” or “very satisfied”!!
- People do adjust



"If you are thinking about it, it's time to give up"

"Think of others and not yourself"

"Try public transport before it's time to give up"

"Stop if your health care provider tells you"

"Think of the money you will save"



What advice would you give others?

- Optometrists should talk to their patients with vision impairment about stopping driving
- Involve the patient's family, where appropriate
- Assist patients to consider alternative modes of transport (including help from family and friends)
- Discuss the positives of driving cessation



Advising Patients

Optometrists have a key role



Advising Patients

Good Vision

- Optimal refraction and VA
- Quality lenses anti-reflection coating
- Take care with MF CLs and night driving (Chu et al., IOVS, 2010)
- Detection of eye disease
- Early cataract surgery
- Early detection of glaucoma and compliance with tx
- Regular eye checks

Advising Patients

Visibility

- Clean windscreen, headlights and spectacles
- Sunglasses (do not wear in dim/dark conditions)
- Daylight (limit night, poor weather conditions, glare)



Advising Patients

Avoid risky situations

- Peak times
- Highway driving
- Be careful of right turns
- Minimise distractions
(mobile phone, radio,
passengers)



Advising Patients

Avoid risky situations

- Be aware of pedestrians, bicycles, motorcycles and other vehicles
- Expect the unexpected



Find a safe way

- Plan ahead
- Clear signs
- Well-marked lanes
- Right turns at controlled intersections
- Easy parking



Advising Patients

Drive a safe car

- Comfortable size and fit
- Automatic transmission
- Anti-lock Brake System
- Maximum visibility (special mirrors to reduce blind spots)
- Top condition



Advising Patients

Stay in good health

- Check in with GP
- Check all medications
- Exercise body and mind



Advising Patients

Take a refresher course

- Driver training schools
- Driving assessment specialist (OT)





[Home](#) › [Safety](#) › [Driving safely](#) ›

Senior drivers

Self-rating assessment

Please answer all the questions

1. I signal and check to the rear when I change lanes

- ☐ Always or almost always
- ☐ Sometimes
- ☐ Never or almost never

2. I wear a safety belt

- ☐ Always or almost always
- ☐ Sometimes
- ☐ Never or almost never

3. I try to stay informed on changes to driving rules and the Road Code

- ☐ Always or almost always
- ☐ Sometimes
- ☐ Never or almost never

4. Intersections are stressful because there is so much to watch from all directions

- ☐ Always or almost always
- ☐ Sometimes
- ☐ Never or almost never

5. I find it difficult to decide when to merge with traffic at onramps on busy state highways or motorways

- ☐ Always or almost always
- ☐ Sometimes
- ☐ Never or almost never

6. I think I am slower than I used to be in reacting to dangerous driving situations

- ☐ Always or almost always
- ☐ Sometimes
- ☐ Never or almost never

7. When I am really upset, it affects my driving

- ☐ Always or almost always
- ☐ Sometimes
- ☐ Never or almost never

8. My thoughts wander when I am driving

- ☐ Always or almost always
- ☐ Sometimes
- ☐ Never or almost never

9. Traffic situations make me angry

- ☐ Always or almost always
- ☐ Sometimes
- ☐ Never or almost never

10. I get regular eye checks to keep my vision at its sharpest

- ☐ Always or almost always
- ☐ Sometimes
- ☐ Never or almost never

Self-rating assessment

11. I check with my doctor/specialist or pharmacist about how the medications I take affect my driving ability

- ☐ Always or almost always, or not applicable
- ☐ Sometimes
- ☐ Never or almost never

12. I try to maintain a healthy lifestyle to help me remain a skilful driver

- ☐ Always or almost always
- ☐ Sometimes
- ☐ Never or almost never

13. My children, other family members or friends have expressed concern about my driving ability

- ☐ Always or almost always
- ☐ Sometimes
- ☐ Never or almost never

14. In the past two years, have you been involved in any traffic incidents where there has been police involvement? Eg: any written or verbal warnings, traffic infringements (does not include parking over limit infringement tickets)

- ☐ None
- ☐ One or two
- ☐ Three or more

15. Have you had any crashes during the past two years?

- ☐ None
- ☐ One or two
- ☐ Three or more

<https://www.nzta.govt.nz/safety/driving-safely/senior-drivers/self-rating-assessment/>



SUPPORTING SENIOR DRIVERS

How friends and family can help

Engage friends and family

2 | NZ Transport Agency

Supporting senior drivers How friends and family can help

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Breaking the News

Setting

- Privacy, involve significant others, connect with the patient, ensure no interruptions

Establish the patient's perception

- “Has anyone spoken to you about your vision and driving before?” “How do you feel about your vision and driving?”

Breaking the News

Giving knowledge and information to the patient

- Warn them. “I’m sorry to have to tell you...”

Address emotions with empathy

- Patient may be tearful, sad, silent, angry or shocked

Strategy and summary

- Important to have and discuss a plan... when they are ready

Will it Matter?

Driverless cars

- Google spending \$30B per year on development



Summary and Conclusions

- There is little evidence that VA screening is the best indicator of driving performance and safety
- More studies are needed on vision-related interventions to maintain road safety
- Optometrists have a key role to play in keeping drivers and the public safe
- Stopping driving is a journey



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