Assessing Fitness to Drive: Past, Present and Future

Mark E. Wilkinson, OD
Clinical Professor of Ophthalmology
University of Iowa Carver College of Medicine
Department of Ophthalmology and Visual Sciences
Director, Vision Rehabilitation Service
UI Wynn Institute for Vision Research

Overview
We will be discussing with case examples:
- Past and current vision standards for driving
- Contrast sensitivity testing
- Useful Field of View testing/training
- Options for wayfinding while driving
- Adapted and autonomous cars
- Driving with a visual acuity and/or a visual field loss
- Changes in visual processing that can occur with age, and their effect on safe driving
- Our responsibilities in assessing fitness to drive

Vision Standards for Driving
- DOT vision screenings are not satisfactory in assessing the functional vision of drivers.
  - Particularly for those with a visual acuity, visual field or cognitive impairment.

Driving Standards: Unrestricted License
- Visual Acuity > 20/40
- Visual Field ≥ 140 degrees
- The minimum standard of 20/40 is based on a recommendation dating back to 1937 by the AMA’s Section on Ophthalmology
  - Originally, in 1925, the minimum standard was 20/50

Night Driving
Functional Visual Acuity is < 20/40
- At speeds > 55 mph with high beams
- At speeds > 35 mph with low beams on
Vision Standards for Driving

- Vision Screening Standard
  - Individuals are not always rejected if the minimum standards are not met.
  - Privileges may be granted after further evaluation of all factors.
  - The process of individual review for those not meeting the minimum standards was first proposed in 1925 and reaffirmed in 1937.

Visual Acuity and Driving

- Visual acuity is widely used in driving regulations, but is a poor predictor of performance. 1, 2
- Correlation of Vision to Accidents < 1% 3
- Uniform vision standards still do not exist in the United States for visual acuity, visual field as well as the use of bioptic telescopes. 4
  - There continue to be no uniform qualification standards for employing a bioptic telescope for driving.

Vision Standards for Driving

- States also have different standards for restricted driving privileges
  - Daylight versus no driving when headlights are required
  - Reduced speed
  - Local versus restricted distance from home
  - No interstate/highway/freeway

Contrast Sensitivity

- Contrast sensitivity is more predictive of driving outcomes in older adults with normal vision. 5, 6
- Contrast sensitivity may also help to differentiate those who are fit to drive. 5
- Currently, contrast sensitivity test results are not considered in driver licensing anywhere in the USA.

Cataracts

- Individuals with cataracts are 2.5x more likely to have an at-fault crash than those without cataracts. 7, 8, 9
- Individuals with cataracts are 4x more likely to report difficulties with driving than individuals without cataracts. 7, 8, 9
- Some individuals with binocular cataracts continue to experience driving difficulties after monocular cataract surgery. 7, 8, 9, 10

Cataracts and Contrast Sensitivity

- Research has shown that improvement in contrast sensitivity after cataract surgery is more important than improvement in visual acuity when assessing driving difficulties due to vision. 5
- Fraser found that contrast sensitivity of less than 1.25 log units was the only independent predictor of crash involvement for individuals with cataracts in the previous 5 years. 10
Useful Field of View (UFOV)

• Conventional measures of visual field assess visual sensory sensitivity.
• UFOV assesses higher-order visual processing skills such as selective and divided attention and visual processing speed under increasingly complex visual displays.
• More closely approximates the complexity of the driving task.

Welcome to UFOV® Test 1
This exercise will measure how fast you can identify a single object.

Welcome to UFOV® Test 2
This exercise will measure how fast you can divide your attention between two objects.

Welcome to UFOV® Test 3
This exercise will measure how fast you can divide your attention between two objects when the outside object is surrounded by clutter.

UFOV Training

• Currently, Useful Field of View test results are not considered in driver licensing anywhere in the USA.
• Training on the UFOV test for several hours using preset criteria for success has been shown to improve not only UFOV test performance, but also the driving performance of older persons.13, 14, 15
  – 10 training sessions over 5 weeks resulted in approximately a 50% lower rate of at-fault MVCs during the subsequent six years when compared to control group.

Bioptic Telescopes

• Kolb in 1970 first reported his study of drivers using bioptic telescopes.11
• Feinbloom in 1977 reported the results of his first 300 bioptic drivers.12
• In his article, Feinbloom reported that the biggest problem drivers faced when dealing with reduced vision (binocular > 20/200) was reading street signs
  – Seeing other traffic, people, animals, etc. was no problem
Bioptic Telescopes

- Currently, in almost 40 states, the acquisition of a bioptic telescope is the only way that an individual with visual acuity less than 20/70 can attempt to qualify for the privilege to drive.
- Past reports have stated that when a bioptic telescope is fit on only one eye, following training in the use of the bioptic telescope, the user is able to maintain peripheral awareness with their fellow eye when viewing through the telescope.

Attentional Blindness

- Human factors research has found that the assertion that an individual can attend to two tasks is much more difficult than originally thought.
- There is a time lag associated with switching from one activity to another.
  - Cell phones and texting
- Additionally, attentional blindness can virtually eliminate the user’s peripheral awareness when viewing through the bioptic telescope.

Attentional Blindness

- Distraction related driving mishaps
  - Inattention blindness—attention to one activity undermines attention to other activities
  - Cost of switching—takes time to switch between various activities

Bioptic Telescopes

- Proponents of bioptic telescopes acknowledge that they are only used for a very small percentage of time when an individual is driving (1-10%).
  - Used primarily for wayfinding tasks such as reading street signs
- In 2014, the need to read street signs has been greatly reduced/eliminated thanks to talking GPS technology.

Potential Visual GPS Technology Pitfalls

- The Department of Transport has previously confirmed that using a smart watch while driving will be treated by police in the same way as offenses involving mobile phones.
- Motorists in the UK face a sentence of up to two years in prison if the use of either device causes a fatal accident, and a £100 fine and three penalty points on-the-spot, if drivers are deemed to be distracted by the gadgets while at the wheel.

Adapted Cars

- For more than 40 years, individuals with physical handicaps have been allowed to demonstrate their abilities to safely operate an adapted motor vehicle and be licensed to drive.
Adapted Cars

- 2014 Mercedes S-Class has 26 sensors that can monitor traffic up to 656 feet ahead, recognize lane markings and use the vehicle ahead as a positioning beacon when no lane markings are visible.

Autonomous Cars

- Google first started developing driverless car technology in 2005.
- They have been testing automated cars since 2010 and announced in April 2014, 700K miles with no accidents.
- In May 2014, a new prototype Google car was introduced with no steering wheel, gas pedal or brake
  - 100% autonomous

Autonomous Cars

- Nevada passed a law on June 29, 2011 permitting the operation of driverless cars in Nevada for test purposes.
- The Nevada Department of Motor Vehicles issued the first license for a self-driven car in May 2012.
- As of December 2013, Florida, California and Michigan have passed laws permitting autonomous cars.
- Audi got licensed for the first autonomous car in CA in September 2014.
- Texas is currently advancing an autonomous car law.

We must remember

- Loss of driving privileges results in:
  - Increased social isolation
  - Decreased quality of life
  - Depression

Depression

- Is common among the elderly in general (3%), and even more common among those that have experienced a significant loss in vision (30%).
- Evidence suggests that driving cessation is also associated with increased symptoms of depression. (VA Report 2007)
Quality versus Quantity

Visual Function
versus
Functional Vision

Drivers with Visual Impairments

- Teenagers with congenital/acquired visual impairments
- Adults with congenital/acquired visual impairments who have never driven
- Adults with acquired visual impairments who will become non-drivers

Abilities Required to Drive Safely

- Sensory ability to perceive changes in a rapidly changing environment.
- Mental ability to judge this information in a timely fashion and make appropriate decisions.
- Motor ability to execute these decisions.
- Compensatory skills to make up for a loss of ability in one or more of the above.

Components of the Driving Task

- Stage 1 - Visual stimuli must be sampled and registered at the sensory level.
- Stage 2 - Once registered, stimuli must be recognized or identified and localized.
- Stage 3 - Once recognized and localized, the driver must decide what action to take.
- Stage 4 - Finally, the driver must execute a motor response to carry out the decision.

Assessing cognitive function as it relates to vision and driving

Why?

How?
Case Example 6

Clock drawing test for dementia

Sensitivity - 86%
Specificity – 96%

The Aging Driver

• Today, more than 7 million people in the US are afflicted with dementia.
  – Alzheimer’s disease is the most common form
• Data indicates that 50% of persons with Alzheimer’s disease continue to drive up to 3 years after they have been diagnosed with the disease.

Stroke

• Survey of 290 stroke survivors
  – 30% returned to driving
• 48% reported that they received no advice about driving.
• 87% reported that they did not receive any type of driving evaluation.

AMA’s - Physician’s Guide to Assessing and Counseling of Older Drivers (2nd Ed.)

• Assess risk factors.
• For those individuals at risk for unsafe driving, recommends a formal assessment of:
  – Vision
  – Cognition
  – Motor Skills
• Refer for a driving assessment when appropriate.

Driving Legalities

• Duty to Warn
  – Legal rational is to provide a means of protecting the patient from an unreasonable risk of harm.
  – Failure to warn patients of conditions that create a risk of injury will be upheld as a cause of action against eye care providers when it can be shown that the failure to warn is the proximate cause of an injury.

Driving Legalities

- Duty to Warn
  - The patient can argue that they had insufficient warning of their impairment, and because of their impairment, their operation of a motor vehicle or other machinery resulted in an injury.
  - Patients whose vision no longer legally qualifies them to operate a motor vehicle should be warned not to drive and a notation to this effect should be entered into the patient's record.

- AMA House of Delegates approved (12/99) a Council on Ethical and Judicial Affairs recommendation that calls on doctors to breach patient confidentiality for the good of both the patient and society.

- The CEJA’s stated that it is “desirable and ethical” for physicians to notify the DMV if an impaired patient they are treating fails to restrict his or her driving appropriately.


Driving Legalities

- Previous court decisions
  - A license to operate a motor vehicle is a privilege and not a right.
  - Driving is subject to reasonable regulations in the interest of public safety and welfare.
  - The suspension or revocation of an operator’s license is not intended as a punishment to the driver, but is designed solely for the protection of the public.

- Visual acuity assessment for licensure.
  - As long as the individual’s VA and/or VF was good enough to allow them to get a license, they can continue to drive until that license expires, regardless of how poor their acuity or field becomes.

- Visual acuity assessment for driving.
  - Those individuals whose VA or VF drops below their State’s licensure standards are no longer legal to drive from that time forward, not just after they come up for renewal.

Two licensure standards for driving

In Iowa

- It is not illegal for a person to drive with vision below the standard.
- "Once they have a license, they are legal to drive until their vision is rechecked, at the time of relicensing."
- "Liability may be a significant concern, but they won’t be illegal" (personal communication IA DOT 1/04).

Patient Questions

- Do you drive an automobile?
- If yes, what type of driving do you do?
- Do problems with your sight cause you to be fearful when you drive?
- During the past six months, have you made any driving errors?
- Is your mobility effected by your vision?
Considerations

- When faced with advocating for continued driving or not, additional testing can be very helpful.
- Contrast sensitivity
- Useful Field of View
- Visual field testing, even in states that do not require it.
  - Non-threshold related testing including at least a I4e and a V4e isopter

Conclusion

- In general, fitness to drive cannot be determined by age, visual acuity and/or visual field alone.
- The functional manifestations of various ocular conditions and the ability of individuals to compensate for their visual impairment varies widely.

Finally

- We need to serve as advocates for those individuals with reduced visual acuity or reduced visual fields, who have the compensatory skills to continue driving safely, despite those reductions.
- We need to advocate for standardization of visual acuity and visual field requirements nationwide.

References


Thanks for your attention

mark-wilkinson@uiowa.edu
UFOV

Kristi Berg, President
Visual Awareness, Inc.
SouthBridge Center
2100 SouthBridge Parkway, Suite 650
Birmingham, AL 35209
T. 205.335.3700 - 818.780.7979
F. 818.780.5352
kberg@visualawareness.com