Assessing Fitness to Drive: Past, Present and Future

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Overview

We will be discussing
• 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.
• Useful Field of View testing/training
• Options for wayfinding while driving
• Recommended vision standards for driving

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

Definition: Visual Function

• Measures how the eye and visual system functions
• Determined by visual acuity and visual field measurements

Definition: Functional Vision

- Describes how the person functions in vision-related activities
  - Reading, mobility, employment, activities of daily living and quality of life
- Takes into account factors such as loss of contrast sensitivity, photophobia, and/or ocular motor problems


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

Drivers with a Visual Impairment

- Safety research has shown that age alone is a poor predictor of driving safety or ability.
- There is no cut off criteria in acuity, contrast sensitivity, or peripheral vision that could be adopted, that would place persons in the high risk category for automobile accidents based on vision scores, which would not include a significant number of crash free drivers as well.

Ball, Owsley, Sloane, et al. Visual attention problems as a predictor of vehicle crashes and older drivers. Investigating Ophth and Vis Science, 34, 3110-23, 1993

Potential Drivers

- It has been estimated that 12 million Americans have best visual acuity of 20/50 - 20/200
  - Approximately 5 million have visual acuity of 20/50 to 20/70
  - Approximately 7 million have visual acuity <20/70 but > 20/200


Drivers with a Visual Impairment

- To date, there has been a lack of empirical evidence identifying a significant predictive relationship between changes in visual function and automobile crashes.


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.

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 did not exist in 1991 and still do not exist in the United States for visual acuity, visual field as well as the use of biopic telescopes. 4
• There are no uniform qualification standards for employing a biopic 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

The Aging Driver

• According to the US DOT:
  – ~19 million older licensed drivers in 2000
  – 36% increase from 1990
  – 14% increase for the total number of drivers

The Aging Driver

• Highway deaths:
  – <65 y/o has decreased by 3% since 1995
  – >65 y/o had increased by 15% since 1995
  – >65 y/o account for 18% of all fatalities
• The number of individuals >65 y/o will double to 60 million in next 15 years.
  • By the year 2020, there will be 75 million individuals, 75 years of age and older.

The Aging Driver

• >85 y/o - largest growing age group.
  – Per miles driven-highest accident rate (2X)
• Crashes among older persons are more likely to cause injury, hospitalization and death.

The Aging Driver

• Elderly drivers have a higher incidence of crashes that involve difficulties processing information from the periphery.
  – Failure to yield the right of way
  – Failure to heed signs
  – Failure to turn safely
  – More frequent junction crashes
• 32% of the intersection crashes in 1999 involved individuals >65 y/o.
Assessing cognitive function as it relates to vision and driving

**Why?**

**How?**

### 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.\textsuperscript{11, 12, 13}
  - 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.

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 eliminates the user’s peripheral awareness when viewing through the biopic telescope.

Attentional Blindness
- Distraction related driving mishaps
  - Inattentive blindness—attention to one activity undermines attention to other activities
  - Cost of switching—takes time to switch between various activities
  - The number of radios with less than 10 buttons has decreased over the past 25 years to ~25%
Case Example 7

Clock drawing test for dementia
Sensitivity - 86%
Specificity – 96%

Wayfinding
• Historically, wayfinding refers to the techniques used by travelers over land and sea to find relatively unmarked and often mislabeled routes. ¹⁴
• These techniques include, but are not limited to, dead reckoning, map and compass, astronomical positioning and, more recently, global positioning. ¹⁴

Bioptic Telescopes
• Kolb in 1970 first reported his study of drivers using bioptic telescopes. ¹⁵
• Feinbloom in 1977 reported the results of his first 300 bioptic drivers. ¹⁶
• 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.

Bioptic Telescopes
• Proponents of bioptic telescopes acknowledge that they are used for a very small percentage of the time when an individual is driving (1-10%).
  – Used primarily for wayfinding tasks such as reading street signs
• In 2013, the need to read street signs has been greatly reduced thanks to talking GPS technology.
Talking GPS
• In 2013, talking GPS systems are readily available as options in automobiles, as stand alone units that can be moved from car to car and also as a convenient apps on most smart phones.

Adapted Cars
• For more then 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
• Google first stated developing driverless car technology in 2005.
• They have been testing automated cars since 2010 and announced in August 2012, 300K miles with no accidents.

Adapted Cars
• Nevada passed a law on June 29, 2011 permitting the operation of driverless cars in Nevada for test purposes.
• The Nevada law went into effect on March 1, 2012.
• The Nevada Department of Motor Vehicles issued the first license for a self-driven car in May 2012.
  – The license was issued to a Toyota Prius modified with Google’s experimental driverless technology
• As of September 2012, Florida and California have also passed laws permitting driverless cars for test purposes.

Adapted Cars
• The first cars capable of communicating with traffic infrastructure and with each other could come on the market within 5-10 years with autonomous vehicles being very common by 2025 – Center for Automotive Research.
• More likely in this time frame there will be assisted-driving cars that self-drive under certain limited conditions.
  – On limited access highways, these cars will maintain a safe following distance and keep pace with traffic ahead and they will center themselves in the driving lane, as long as the lane markings are clearly defined or there is another car ahead to follow.

Smart Cars
• 2014 Mercedes S-Class will have 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.
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.

What should we be doing?

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

Driving Legalities
• 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

• Mandatory reporting concerns include the question of relative benefit
  – If mandatory reporting detours someone from confiding or getting necessary care, because he fears losing driving privileges, then reporting statutes could backfire, creating more hazardous drivers

Two licensure standards for driving

• 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.

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?

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.
**Conclusion**

- We must use our knowledge and tools to assess competency to drive and/or refer for additional assessment as appropriate.
- We are responsible for helping our patients understand when they should restrict their driving or retire from driving all together.

**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.

**Thanks for your attention**

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**National Vision Standards for Driving**

*Proposed*

**National Vision Standards for Driving**

*Proposed*

- An unrestricted, non-commercial drivers’ license can be issued to anyone with a visual acuity of 20/40 or better in one or both eyes, with an uninterrupted (excluding the physiologic blind spot) visual field of 140° horizontally (measured with a V4e isopter or its equivalent) in one or both eyes and no other conditions which may impair driving ability.

- A restricted non-commercial drivers’ license that allows for driving when headlights are not required, can be issued to anyone with a visual acuity of <20/40 to 20/70 in one or both eyes, with visual fields as noted in the previous slide and no other conditions which may impair driving ability.
National Vision Standards for Driving (Proposed)

• Individuals who should be judged on an individual basis include:
  – those with visual acuity of <20/40 to 20/70, who wish to drive when headlights are required,
  – those with visual acuities less than 20/70 but better than 20/200 who wish to acquire driving privileges or continue driving, perhaps with other restrictions.

National Vision Standards for Driving (Proposed)

• Individuals who should be judged on an individual basis include:
  – those with an uninterrupted (excluding the physiologic blind spot) visual field, measured horizontally, less than 140° but greater than 20°,
  – those with an interrupted visual field, measured horizontally, greater than 20°.

National Vision Standards for Driving (Proposed)

• For any of the individuals to be judged on an individual basis, a report of a recent eye examination should be submitted to the Department of Motor Vehicle or its equivalent at the time of licensing.
• This report should include at a minimum best corrected visual acuity, need for glasses or contact lenses, extent of horizontal visual field, presence of blind spots (excluding the physiologic blind spot), and diagnosis and prognosis of the eye condition.

National Vision Standards for Driving (Proposed)

• These individuals should have no other conditions that alone or in combination with the visual deficit may impair driving ability.
• Licensing for individuals judged on an individual basis must be based on being judged a safe driver during an on the road evaluation by a qualified driving instructor or driving evaluator.

National Vision Standards for Driving (Proposed)

• Individuals with best corrected visual acuity of 20/200 or worse in the better eye or a visual field of 20° horizontally or less should not drive a motor vehicle except as determined on a case by case basis following appeal to the licensing authority.

National Vision Standards for Driving (Proposed)

• Bioptic telescopes should not be used to meet static visual acuity requirements for licensing nor be required for licensing, but may be used for driving, following training in their use for driving and demonstrated ability to use them safely and efficiently.
National Vision Standards for Driving
(Proposed)

- The final licensing responsibility should rest with the Department of Motor Vehicles, and be based on an evaluation of actual driving performance.

- Visual acuity and visual field standards should be for qualifying for driving, not for licensure, placing responsibility on individual drivers to know whether they meet the visual criteria to continue operating a motor vehicle between license renewal periods.

- Eye care professionals should be the only people to make the decision concerning whether a person meets the legal visual requirements to qualify to drive.

- Until evidence based visual data suggests otherwise, only after an individual with a visual acuity or visual field limitation is determined to be visually qualified, should a behind the wheel test to acquire or maintain driving privileges be given.

Additional 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

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References