Senior Driver Research Projects: Translating Research into Practice within the Community

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GSA Pre-Conference Workshop on Current and Future Challenges in Designing Behavioral Interventions
• Karlene Ball is one of the inventors of the UFOV test and speed of processing training program. She is a stockholder and serves on the Scientific Advisory Board of Posit Science, and is a consultant and stockholder in the Visual Awareness Research Group, Inc.
• Older adults’ difficulty with everyday vision & cognition.
• New methods for evaluating everyday vision & cognition.
• What are the underlying mechanisms for problems?
• What are the underlying mechanisms for improvements?
I'll have a cheeseburger, large fries, black coffee...

I'm starting to think retesting seniors for driving isn't a bad idea!
Roybal Center for Translational Research on Aging & Mobility

- Impact of Visual Interventions on Driving Competence
  Cataract Surgery
- Impact of Cognitive Interventions on Driving Competence
  Speed of Processing Training
- Maryland Field Study – Collaborative
- Impact of Glaucoma on Driving Competence
- ACTIVE (Advanced Cognitive Training for Independent and Vital Elderly)
- SKILL (Staying Keen in Later Life)
- PACES (Physical And Cognitive Exercise Study)
Collaborations

- Easter Seals
- Departments of Motor Vehicles
- Medical Advisory Boards
- Medical Community (hospitals, clinics, etc.)
- AARP
- Other Universities
- Automobile Manufacturers
- Insurance Companies
- National Highway Safety Administration
- Corporations
Poor UFOV® Test Performance is Associated with Higher Crash Risk

Relative Crash Risk
Low UFOV performers compared to high UFOV performers

- Relationship between UFOV assessment and crash risk shown in multiple studies
- More than 10,000 participants
- Very consistent results

<table>
<thead>
<tr>
<th></th>
<th>Relative Crash Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owsley 1991</td>
<td>4.2</td>
</tr>
<tr>
<td>Ball 1993</td>
<td>6.0</td>
</tr>
<tr>
<td>Owsley 1998</td>
<td>2.2</td>
</tr>
<tr>
<td>Sims 2000</td>
<td>1.9</td>
</tr>
<tr>
<td>Ball 2005</td>
<td>2.0</td>
</tr>
<tr>
<td>Rubin 2007</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Owsley 1991
Ball 1993
Owsley 1998
Sims 2000
Ball 2005
Rubin 2007

• Retrospective
• Prospective
Maryland Project

- Large sample collaborative field study (N=2,114) with a subsample of five-year longitudinal data (n=1,015).
  - National Institute on Aging; Maryland Department of Motor Vehicles; NHTSA
- Purpose: To evaluate a brief screening battery developed for use in the Department of Motor Vehicles
Results (1998 data)

- Among drivers 55 years of age and older with relatively intact vision (20/70 far visual acuity and 140 degrees visual field), the following measures were predictive of future at-fault motor vehicle crash involvement: (Ball et al., 2006)
  - Age (older) Gender (Male) History of falling
  - Poorer cognitive performance measured by UFOV®, Trails B, and MVPT

Now beginning intervention phase in Maryland
Older Driver Research Project

• Between 2004 and 2010, adults aged 75 and older were issued an invitation through premium renewal notice (N=109,184)
• Potential participants scheduled an evaluation through UAB
• Evaluations were made within 50 miles of client’s home
• Participants who passed the UFOV screening test (risk category of 1 or 2) received a *Qualifying Certificate* that could be presented to their State Farm agent for up to a 10% discount on elements of their auto insurance.

• 2/3 of the participants in this age group qualified under this criterion.

• Qualifying participants retained their discount for up to two years.

• Non-qualifying participants could retake the assessment after 6 months.
At Fault Crash Results

- Crash records collected through August 31, 2005
- Crashes categorized as
  - Participant at fault
  - Participant not at fault
  - Both at fault
- At fault determined by panel of three judges who read each report (N=462)
Senior Driver Project Conclusions

• Non-qualifying participants (i.e., those not receiving the discount) were:
  • **1.85 times more likely to have an at fault crash** in the next 1.29 years (prospective state records).
  • **2.73 times more likely to have a claim**, classified as at fault, following their assessment.
• Insurance claim amounts were significantly **higher for non-qualifiers** for all claim types except for one category
• Across all claims, the **average cost was more than twice as high for non-qualifiers than qualifiers.**
Can We Change a Person’s Driving?

• One method is through Speed of Processing training:
  • Trainer-guided practice of computer-based nonverbal exercises involving target detection, identification, discrimination and localization
  • Modifiable exercises that are customized to the individual’s level and current needs
  • Goal is to process increasingly difficulty tasks at briefer display speeds until mastery is attained
ACTIVE: Clinical Trial

ACTIVE
(Advanced Cognitive Training for Independent and Vital Elderly)

To test the effectiveness and durability of three distinct cognitive interventions in improving the performance of older adults on basic measures of cognition and on measures of cognitively demanding daily activities.
• This training has demonstrated transfer to:
  • Improved processing speed- 1 session can counteract 4.95 months of age-related decline (Ball et al, in prep)
  • Everyday activities, via TIADL and Everyday Speed (Edwards et al., 2002 & 2006; Ball et al., 2002; Willis et al., 2006)
  • Health-related Quality of Life (Wolinsky et al., 2006a; 2006b)
  • Self-rated Health (Wolinsky et al., 2010)
  • Fewer depressive symptoms (Wolinsky et al., 2009)
  • Improved locus of control (Wolinsky et al., 2009)
  • Decreased Health expenditures (Wolinsky et al., 2009)
  • and driving-specific outcomes such as...
• Processing speed training has demonstrated transfer to driving outcomes such as:
  • Maintained driving mobility (Edwards et al., 2009; Ross et al, in prep)
  • Less likely to stop driving (Edwards et al., 2008)
  • Make fewer dangerous maneuvers (Roenker et al., 2003)
  • Half as likely to suffer an at-fault crash over five years (Ball et al, 2010)
    • Unadjusted: RR=0.55 (0.33-0.92) person-time
    • Unadjusted: RR=0.58 (0.35-0.97) person-miles
    • Adjusted*: RR=.52 (0.31-0.87) person-time
    • Adjusted*: RR=.57 (.034-0.96) person miles

• Processing speed training can help older adults drive safely for a longer amount of time.

*Adjusted for age, gender, race, education, Mini-Mental State Exam score, self-rated health status, vision, depression and site.
How can we improve and disseminate cognitive training to older adults?
Posit Science has been evaluating their new consumer version of speed of processing training with insurance partners.
One way to evaluate effectiveness is to examine changes in Insurance Ultimate Loss Ratios (ULRs) after training.

\[
\text{ULR} = \frac{\text{Cost of claims}}{\text{Premium}}
\]
The Hartford Collaboration

Pilot project:

1. Mail offering sent to 100,000 policyholders aged 50+
2. Mailing started August 2010
3. Estimate effect on Ultimate Loss Ratios
Drivesharp visual training program

Road Tour

Multiple Object Tracking

Visual Sweeps

- Computer based training
- Done at home
- Ten hours to complete
- Three exercises
Road Tour

Pack your bags and toss them in the backseat. Route 66—the ‘Mother Road’—awaits! The journey will take you to historic sites, natural wonders, kitschy attractions, and architectural treasures on your way from Los Angeles to Chicago.
Multiple Object Tracking
Visual Sweeps
As of May 2011 (analysis lock date):

<table>
<thead>
<tr>
<th></th>
<th>N</th>
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<tbody>
<tr>
<td>Requested Drivesharp</td>
<td>8977</td>
</tr>
<tr>
<td>Started training</td>
<td>5135</td>
</tr>
<tr>
<td>≥ 1 hour</td>
<td>3688</td>
</tr>
<tr>
<td>≥ 5 hours</td>
<td>2662</td>
</tr>
<tr>
<td>Completed</td>
<td>2277</td>
</tr>
</tbody>
</table>
Analytic Approach

Initial Steps:

1. Establish relationship between baseline performance on exercises and previous crash history.

2. Verify that users get better at the exercises therefore reducing crash risk.

3. Estimate effect on ULRs
Users split into 3 categories based on performance before training

<table>
<thead>
<tr>
<th>Percentile</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 25</td>
<td>Poor</td>
</tr>
<tr>
<td>&gt;25 &amp; &lt;75</td>
<td>Average</td>
</tr>
<tr>
<td>75-100</td>
<td>Good</td>
</tr>
</tbody>
</table>
### Crash Rates in Previous 5 years

#### UFOV

<table>
<thead>
<tr>
<th>Category</th>
<th>Crash Rate</th>
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<tbody>
<tr>
<td>Good</td>
<td>~13%</td>
</tr>
<tr>
<td>Average</td>
<td>~14%</td>
</tr>
<tr>
<td>Poor</td>
<td>~16%</td>
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#### MOT

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<th>Category</th>
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#### Visual Sweeps

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~25% elevated crash rate for Poor category
But is elevated risk already captured in the premium rating? Need to look at Ultimate Loss Ratios (ULR).

If baseline visual performance risk is already captured in other insurance risk factors, then ULRs will be flat across the 3 categories.
Crash Rates in Previous 5 years

Ultimate Loss Ratios

<table>
<thead>
<tr>
<th>Visual Sweeps</th>
<th>Good</th>
<th>Average</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULR</td>
<td>64.0%</td>
<td>66.7%</td>
<td>95.3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ultimate Loss Ratios</th>
<th>Good</th>
<th>Average</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>UFOV</td>
<td>60.3%</td>
<td>70.3%</td>
<td>87.9%</td>
</tr>
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<table>
<thead>
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<th>Ultimate Loss Ratios</th>
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<th>Average</th>
<th>Poor</th>
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<tbody>
<tr>
<td>MOT</td>
<td>67.0%</td>
<td>62.6%</td>
<td>84.4%</td>
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Perceptual performance is an independent risk factor
Training Effects on Performance

UFOV

- Good: 91.5%
- Average: 6.7%
- Poor: 1.8%

MOT

- Good: 59.3%
- Average: 34.5%
- Poor: 6.2%

Visual Sweeps

- Good: 46.1%
- Average: 43.7%
- Poor: 10.1%

Shift to better performance categories
Estimated Changes in ULR

Performance distribution **after** training

**Assumption:** shifting into a better performance category reduces ULR to level of user in that category before training.

**Savings**
Reduction in ULR saves $60 per year on a $1000 premium, for up to 5 years.
Savings
Reduction in ULR saves $202 per year on a $1000 premium, for up to 5 years.
Thank you.

For more information on our current research studies and research findings: http://crag.uab.edu/crag/