

**TRANSLATING LABORATORY MEASURES TO REAL-WORLD OUTCOMES:  
APPLICATION OF THE UFOV<sup>®</sup> TEST IN AN INSURANCE COMPANY SETTING**

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**Summary:** Poor performance on the Useful Field of View (UFOV<sup>®</sup> test) has been linked to negative driving outcomes, such as crashes. The UFOV<sup>®</sup> test was given to a sample of drivers 75+ years across the state of Alabama (N=2235) as a means of attaining a reduction in insurance rates if successful on the test. Results revealed that retrospectively, participants who failed the assessment were 1.65 times more likely to have an at-fault crash and 1.66 times more likely to have an at-fault insurance claim in the previous five years as compared to participants who passed the assessment. Prospectively, these same participants were 1.85 times more likely to have an at-fault crash and 2.73 times more likely to have an at-fault claim in the subsequent 1.29 years after assessment as compared to participants who passed the assessment. To the authors' knowledge, this is the first translational study to investigate the impact of offering an insurance discount for passing such an assessment on prospective at-fault crashes and at-fault insurance claims.

## INTRODUCTION

The aging baby-boomer cohort, coupled with recent demographic changes of the growing proportion of the oldest-old, has resulted in more active older drivers than ever (National Highway Traffic Safety Administration, 2008). As a result, families, policy makers, and health practitioners struggle to find the balance between the increased crash risk in a subset of older at-risk drivers and maintaining the independence of older adults who are still fit to drive (Ball et al., 2006; Fain 2003; Wang & Carr, 2004). In the midst of this struggle lies the need for objective performance-based measures that will accurately and reliably predict the unsafe drivers from the safe drivers. Such measures need to be brief and sufficiently automated so that they can be administered quickly by a broad range of persons. One such screening measure—usually used in combination with other assessments—that has been administered in the field is the UFOV<sup>®</sup> test (Edwards et al., 2006). The UFOV<sup>®</sup> test is a computerized and standardized assessment of visual processing speed that has been developed over the last 25 years. Research has demonstrated, prospectively and retrospectively in over 10,000 participants, that persons who perform poorly on this assessment are over two times more likely to suffer an at-fault crash, see Figure 1 (Ball & Owsley, 1993; Ball, Owsley, Sloane, Roenker, & Bruni, 1993; Ball, et al., 2006; Clay, et al., 2005; Owsley, Ball, et al., 1998; Owsley, Ball, Sloane, Roenker, & Bruni, 1991; Owsley, McGwin, & Ball, 1998; Rubin, et al., 2007; Sims, McGwin, Allman, Ball, & Owsley, 2000). The UFOV<sup>®</sup> test is also predictive of other mobility indices such as increased risk of falls (Staplin, Gish, & Wagner, 2003), reduced lifespace and driving space (Owsley, Stalvey, Wells, & Sloane, 1999; Ross et al., 2009), as well as everyday activities (Owsley, Sloane, McGwin, & Ball, 2002).

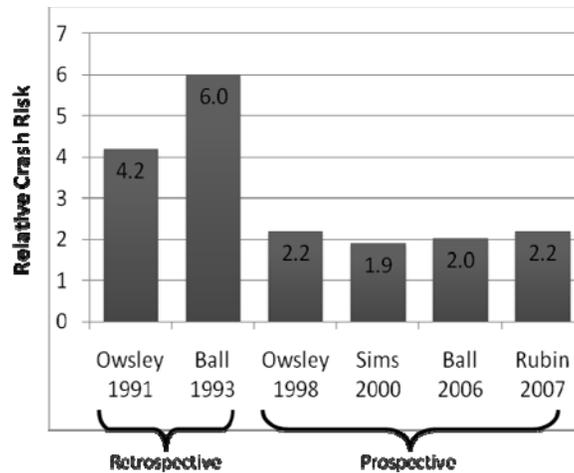


Figure 1. Relative crash risk of low vs. high UFOV test performers

The UFOV<sup>®</sup> test can be performed quickly and be self-administered over the Internet. This assessment has sparked interest and was used for research purposes in the Maryland Motor Vehicles Administration (Ball et al., 2006) and by State Farm insurance company for the assessment of older drivers, thus allowing this research to be translated into the real world. The second project is the focus of the current study which aims to investigate the impact of instituting an insurance discount on crashes and insurance claims for older drivers who are determined to be at a lower-risk for crashes via the UFOV<sup>®</sup> test.

## METHODS

### Procedure and Participants

Data for this study came from the Senior Driver Research Project, which was conducted in collaboration with State Farm Insurance Company, Visual Awareness Research Group, Inc., and the University of Alabama at Birmingham's Edward R. Roybal Center for Translational Research on Aging and Mobility between 2004 and 2010. Alabama drivers aged 75+ who were insured by State Farm and designated as the primary driver on their policy were invited to participate through a brochure provided in their insurance renewal bill. Participants could qualify for up to a 10% discount on aspects of their automobile insurance rates for the subsequent two years if they exceeded a predetermined cut-off score on the UFOV<sup>®</sup> test (Psychological Corporation, 1999). Participants who did not qualify (non-qualifiers) could re-take the assessment after 6 months. Participation or nonparticipation in the study remained confidential. Potential participants could make assessment appointments in one of ten study sites throughout the state using a toll-free number with UAB Center staff. Only participants who passed the assessment and presented certificates to their insurance agent were known to State Farm to have participated in the study.

### Measurements

*Visual Processing Speed.* The UFOV<sup>®</sup> is a computerized assessment of visual speed of processing. The UFOV<sup>®</sup> version used in this study consisted of three subtests (stimulus

identification; divided attention; selective attention) on a personal computer with a 17 inch touch screen monitor. This was an abbreviated version which used an algorithm to determine if a participant needed to complete all three subtests or only two subtests based on participant's performance. For each subtest, targets are displayed in varying durations (16.67-500ms) via the double staircase method. Central targets are presented in a 3 cm x 3 cm fixation box and peripheral 2 cm x 1.5 cm targets (when applicable) are presented in a fixed eccentricity of 12.5 cm from the central target at one of eight radial locations. A visual mask is displayed after stimuli presentation. The display duration, or produced 'speed', is given for each subtest. This duration is the threshold (time, ms) at which stimuli remained on the screen long enough for participants to achieve 75% accuracy of both (when applicable) tasks within each subtest.

The first subtest (stimulus identification) requires that participants correctly identify whether the central stimulus was a car or truck. The second subtest adds a peripheral target of a truck. Participants must both identify the central stimulus (car or truck) and localize where the peripheral target was presented (one of eight fixed radial locations). The third subtest (selective attention) is the same as the previous subtest; however, the distracters (triangles) are added to the screen.

Two forms of the UFOV<sup>®</sup> test were administered in this study. First, a newly developed brief UFOV<sup>®</sup> test was given. This assessment consisted of three practice trials, followed by three easy trials (above threshold, therefore slower) and six difficult trials (below threshold, therefore faster) for subtest 2. This first assessment was given to pilot the new briefer UFOV<sup>®</sup> test which was self-administered and took approximately five minutes. The second assessment was the abbreviated three subtest version test given in the standard manner described above (Psychological Corporation, 1999).

*Crash Records.* The main outcome variable was state-reported crash records. Retrospective (prior five years) and prospective (post 1.29 years) records were collected through August 2005. A panel of three independent judges determined if participants were (a) at-fault, (b) not at-fault, or (c) both involved parties were at-fault. Crash records (n = 462) were collected and coded by fault status.

*Insurance Claims.* State Farm claims records were provided to a third party, as were performance test data from UAB. The third party matched the records, providing de-identified analysis files back to both the UAB investigators, as well as State Farm.

## RESULTS

Unadjusted odds ratios (OR) and 95% confidence intervals (CI) were used. Results revealed that retrospectively, nonqualifying participants (those who did not pass the three subtest UFOV<sup>®</sup> assessment) were 1.65 times more likely (95% CI 1.21-2.24) to have an at-fault crash and 1.66 times more likely (95% CI 1.46-1.88) to have an at-fault insurance claim in the previous five years as compared to qualifiers. Prospectively, these same participants were 1.85 times more likely (95% CI 1.05-3.27) to have an at-fault crash and 2.73 times more likely (95% CI 2.13-3.48) to have an at-fault claim in the subsequent 1.29 years after assessment as compared to qualifiers. Insurance claim costs were significantly higher for non-qualifiers as compared to

qualifiers ( $p < .05$ ). Additionally, the new piloted brief UFOV<sup>®</sup> was a good indicator of crashes as participants who failed this assessment were 1.94 times more likely (95% CI 1.06-3.55) to have an at-fault crash in the subsequent 1.29 years after assessment.

## DISCUSSION

To the authors' knowledge, this is the first translational study that has investigated a driving assessment in terms of objective crash outcomes and insurance claims and costs throughout an entire state. Both the three subtest version UFOV<sup>®</sup> and the brief UFOV<sup>®</sup> test were significantly predictive of retrospective and prospective at-fault crash and insurance claims. Given the rising cost of vehicle insurance for older adults, this has promising implications. The findings of this research parallel previous research on the predictive nature of the UFOV<sup>®</sup> test in predicting motor vehicle crashes among older adults.

An additional aim within the Senior Driver Research Project was to evaluate a much briefer version of the UFOV<sup>®</sup> test. Although this second version was not applicable to a discount on insurance premiums, results indicated that it (consisting of only 3 practice trials and nine test trials) was predictive of prospective at-fault crashes; drivers who failed this test were 1.94 times more likely (95% CI 1.06-3.55) to have an at-fault crash. This is a potentially promising area of research as the demand for faster screening measures increases.

In this study the UFOV<sup>®</sup> test was given to determine possible insurance discounts. The authors believe that this is a good compromise between older drivers and insurance companies as it provides some financial relief to drivers who are less likely to suffer an at-fault crash. This research should not be extended to the conclusion that such a test should be used to determine licensure. Albeit, the UFOV<sup>®</sup> test may be a good indicator of which older drivers should be referred for a more extensive driving assessment. Computerized tests, such as the UFOV<sup>®</sup> test, are likely to be important for driving safety evaluation in the future to interested state agencies, industry, and insurance companies. These tests are becoming increasingly brief and may be self-administered in a variety of settings (e.g., at home on the internet). This application may be of interest to older adults who wish to assess themselves in regards to processing speed and crash risk.

An area currently under investigation as an outgrowth of this study is the application of cognitive fitness training called visual speed of processing training. Persons who have undergone such training have been found to experience *improved processing speed/cognition* (Ball et al., 2002; Roenker, Cissell, Ball, Wadley, & Edwards 2003; Willis et al., 2006), improvements in speeded *everyday activities* (Ball et al., 2002; Edwards et al., 2002; Edwards, Wadley, Vance, Roenker & Ball, 2005; Willis et al., 2006), *maintained health-related quality of life* (Wolinsky, Unverzagt, Smith, Jones Wright et al., 2006), *reduced risk of depression* (Wolinsky et al, 2009), *maintained health* (Wolinsky et al., 2010), and *reduced health expenditures* (Wolinsky et al., 2009). Specially related to driving, persons who have completed this training have *demonstrated 40% fewer dangerous maneuvers* in on-road driver tests (Roenker et al., 2003), a *50% reduction in at-fault crashes* across a five-year period (Ball, Edwards, Ross, & McGwin, 2010), and *maintained driving mobility* (Edwards et al., 2009).

In conclusion, this study was a successful in the pairing of traditional research and industry partners. Both the abbreviated and pilot versions of the UFOV<sup>®</sup> test were successful in predicting prospective and retrospective at-fault crashes and insurance claims. Future research should focus on other tests that may be needed to determine driving safety in persons who are classified as 'at-risk' based on broad screening measures. Additionally, cognitive and other intervention programs should be further investigated given the promise of such interventions in sustaining safe mobility among the growing population of older drivers. Such interventions may not only improve safety on the road for all drivers, but also has the potential to improve public health overall. However, it will require translational research such as partnering with insurance companies and other industries to determine the feasibility and efficacy of such approaches.

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