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Visual Scanning Training For Older Drivers

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16. Abstract

This study examined the effectiveness of a visual scanning training program administered by a generalist occupational therapist (OT), conceived as an intervention to improve the performance of healthy older drivers on this skill. Researchers recruited 89 participants, divided equally between males and females 70 and older, who were randomly assigned to treatment and control groups. The training program consisted of four, 1-hour sessions. Developed by a certified driver rehabilitation specialist (CDRS), this program included exercises to be led by the OT, on a one-on-one basis. The control group received an equal-contact intervention consisting of discussions about more generic traffic safety topics, led by an occupational therapy student. A different CDRS, "blind" to group assignment, administered three on-road evaluations for each participant: pre-intervention, immediately post-intervention, and 3 months post-intervention. During each on-road evaluation a camera recorded driver face video in sufficient detail to support later analyses of the frequency, duration, and direction of eye glances away from the forward line of sight. The remaining measure was a post-intervention questionnaire completed by the treatment group to gauge their perceptions of the value of the training exercises and if and how they would apply what they learned in everyday driving. Researchers calculated change scores for the road tests and eye glance metrics for each participant at both post-intervention periods, relative to their pre-intervention performance levels. There were no significant differences between groups on any of the performance measures. The subjective data showed that participants perceived the training to have high value to help them drive more safely. This report concludes with a discussion of the study's implications for clinical practice.

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Table of Contents

List of Figures

List of Tables

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- **Chantel Post**, administrative assistant, conducted study participant screening, obtained participant informed consent per IRB-approved procedures, and coordinated participant scheduling throughout the duration of the study.
- **Janet Stohler**, OTR/L, CDRS, owner, Driver Side Rehab, LLC, provided on-road driving evaluations to all treatment and control group participants, with three sessions per driver, over a period of more than 6 months.
- **Caroline Brooks**, OTR/L, applied her training by the visual scanning training program creator to deliver the training exercises to the treatment group in this study, demonstrating its applicability to generalist OT practitioners.
- **Tiffany Imes**, occupational therapy student, facilitated small group discussions among the control group participants in this study.
- **Peter Nebel,** engineer, was responsible for the hardware/software development required to present the video stimuli in the training exercises.
- **Teegan Kelly,** engineer, was responsible for the design of the PVC car frame.
- **Janice Lutz-Vanhoy**, Arbor Acres wellness arts coordinator, hosted recruitment efforts and secured space for the treatment and control group activities, and all other research needs; provided study information to residents' monthly newsletter.

Executive Summary

This investigation sought to develop and evaluate an intervention to improve older driver safety that appeared promising in previous NHTSA-sponsored research. In the earlier study, *Validation of Rehabilitation Training Programs for Older Drivers* (Staplin et al., 2013), researchers reported preliminary evidence that a novel visual scanning training (VST) program, designed to be delivered in one-on-one sessions by a generalist occupational therapist (OT) in a clinical setting, could enhance driver performance by targeting visual field expansion (the simultaneous processing of multiple visual stimuli) supported by exercises to improve visual search routines. A certified driver rehabilitation specialist (CDRS) developed this program through adapting principles found in a prominent text on visual attention (Mills, 2005).

The current effort aimed to address several goals. While the overriding objective was to obtain evidence that could further validate the preliminary findings referenced above, researchers sought to do so using a modified version of the previous training protocol. An expert panel indicated that it was essential to eliminate behind-the-wheel sessions that had been used to reinforce the in-clinic exercises in the previous study in order to allow for widespread application of this training by generalist OTs. The current study aimed to determine the effectiveness of this modified version of the training protocol in improving driver scanning and driving performance.

Participants for the current study included 89 active drivers ranging in age from 70 to 100. To evaluate training effects, researchers analyzed CDRS-administered road test scores as well as glance behavior based on video of drivers' faces during the evaluation. Questionnaire responses provided participants' perceptions of the value of the VST program.

Researchers hypothesized that, compared to a control group, participants who completed the training protocol would exhibit improved performance in driving tasks that required monitoring multiple stimuli (e.g., negotiating an intersection or turning left across traffic) from a pre-intervention to an immediate and to a 3-month post-intervention driving evaluation. They also predicted that participants in the training group, relative to the control group, would show significant increases in the frequency and/or the duration of glances directed away from the forward view at the immediate and 3-month post-intervention assessments. But, data did not support any of these hypotheses; analyses revealed no significant differences in the performance of treatment relative to control group drivers at either of the post-intervention periods.

A discussion of these findings suggested potential limitations in the research design. First, the absence of on-road training sessions may have diminished participants' transfer of what they learned in the training exercises to on-road driving. Next, a driver's behavior during an on-road evaluation by a CDRS is subject to certain "demand characteristics" as participants listen to and interact with the CDRS. In addition to providing verbal instructions for route navigation, the CDRS often converses with the participant throughout the drive—an intentional part of the evaluation that can reveal difficulties related to divided attention deficits. This conversation may have affected driver performance in such a way that participants did not exhibit enhanced scanning behavior during the CDRS evaluations even if they may have done so when driving independently, without a CDRS in the vehicle. Finally, perhaps the most significant limitation of the experimental design was applying a measure of effectiveness that relied on snapshots of driver behavior, obtained under conditions subject to the potentially confounding influences noted above, rather than using naturalistic data collection methods to monitor changes in

scanning activity over time, as participants drove their own vehicles while going about their normal routines.

Juxtaposed with the performance data, questionnaire responses from those who completed the training program indicated that participants felt strongly that what they learned through the exercises would help them drive more safely. They considered the training valuable; not only would they recommend the training to friends and relatives, a plurality indicated that they would be willing to pay up to $50 for the program, *with or without* an auto insurance discount.

The authors suggest that the present study may be viewed as a beta test that revealed both strengths and weaknesses of the VST program. A complete curriculum was developed, and delivered by a generalist OT to older drivers, who overwhelmingly felt the training program would help them drive more safely. An affordable training platform was designed, built, and documented in sufficient detail to be easily replicated. This platform offers the flexibility to provide VST to diverse populations, and may merit further evaluation in applications that are unconstrained by the limitations noted above.

Introduction

Background

Exposure-based analyses have consistently shown increased crash rates as drivers age into their 70s, 80s, and beyond, and have identified situations under which older drivers are most at risk (Stutts et al., 2009). The riskiest situations often placed heavy demands on visual search and visual attention, such as maneuvers at intersections and merging into traffic.

Studies examining drivers' glance behaviors as they approach and navigate through intersections found that older drivers scan left and right less often than other drivers, and they were more likely to focus straight ahead or in the intended direction of travel (Romoser et al., 2013; Scott et al., 2013). Older drivers also looked at their side and rearview mirrors significantly less frequently and failed to look directly toward their blind spots (Lavallière et al., 2011). Finally, older drivers with a narrowed attentional visual field in the vertical direction were significantly more likely to run red lights (West et al., 2010). These findings may explain older drivers' over-representation in crashes at intersections and when changing lanes.

As researchers have gained better understanding of age-related declines in safe driving abilities, they have worked to develop strategies and techniques to ameliorate the risks. One example is the commercialization of a computer-based training protocol derived from the body of research on the "useful field of view" (e.g., Ball et al., 2010). As an alternative training approach, a CDRS developed a program that adapted principles from a prominent text on visual attention (Mills, 2005). The program focused on visual field expansion, simultaneous processing of multiple visual stimuli, and ocular skill exercises (visual search routines). It could be administered by a generalist OT in one-on-one sessions in a clinical setting; sessions could be supplemented by in-vehicle sessions to reinforce the concepts.

In a previous NHTSA study, *Validation of Rehabilitation Training Programs for Older Drivers* (Staplin et al., 2013), researchers administered both programs to small groups of randomly assigned drivers 65 and older. Post- versus pre-training driving performance, scored by a CDRS during an on-road evaluation, was compared to a control group who received a neutral (placebo) training activity. The OT-administered VST demonstrated promising results, was regarded by participants as more helpful to safe driving, and was likely to be recommended to friends or family members. While the results were encouraging, they were understood to be preliminary, needing confirmation in a larger study that would also support refinement of training methods and material. One key question was whether training efficacy could be demonstrated using only an in-clinic protocol, i.e., without an in-vehicle component. Eliminating the in-vehicle component would enhance the potential for wider implementation by generalist OTs as many do not have access to vehicles to use in therapeutic contexts.

Objectives

This project answers specific research questions about the effects of the VST protocol for older drivers and about their attitudes toward the training procedures and perceptions of its benefits. Of primary interest was to determine:

- whether participants who completed VST exhibited improved performance during a driving evaluation on tasks that required monitoring multiple stimuli (e.g., negotiating an intersection or turning left across traffic) from before the intervention to immediately

after, and then 3 months after training, as compared to control participants who participated in a neutral, equal-contact activity;

- whether participants in the training group, as compared to the control group, would show significant increases in (1) the frequency and/or (2) the duration of glances directed away from the forward view at immediate and 3-month post-intervention assessments, relative to the pre-intervention road test;
- whether training effects differed as a function of participant age or sex;
- whether study participants who completed VST believed the training improved their ability to drive safely and was worth their time and effort given the perceived benefit;
- whether study participants would recommend the training to friends; and
- how much participants would pay for such training.

Literature Review and Expert Panel

Literature Review

Researchers conducted a review of studies published from 2005 to 2016 in the peer-reviewed literature focusing on older (age 70+) drivers' visual scanning ability and on evaluations of training in visual scanning or similar skills for older adults. The purpose of the review was to inform revision of the VST protocol and to assist in data collection design development. NHTSA previously published the literature review methodology and findings (Lococo & Staplin, 2018). Findings relevant to VST revisions are presented below.

- Older drivers scanned left and right less frequently than other drivers and were more likely to focus straight ahead or in the intended direction of travel (Romoser et al., 2013; Scott et al., 2013).
- Older drivers sampled information from their side and rearview mirrors and looked directly toward their blind spot significantly less frequently than other drivers (Lavallière et al., 2011).
- Older drivers with a narrowed attentional visual field in the vertical direction were significantly more likely than other older drivers to run red lights (West, et al., 2010).
- People with age-related attentional visual field declines may not experience decreases in attentional breadth and scope but instead have deficits in attentional disengagement. Researchers called this "sticky attention," which slows disengagement from a current locus (Cosman et al., 2011; Pesce et al., 2005).
- Older drivers may have acquired the habit of fixating on their intended path of travel to avoid collisions, which could compensate for their perceived age-related diminished capabilities. Although such fixations can reduce awareness of peripheral threats, this behavior may have been reinforced as a safe strategy (Romoser et al., 2013).
- Active learning methods (practice and feedback in a contextually face-valid environment) were more effective than solely passive learning methods (lecture or video) for training older drivers. Further, active training with feedback and practice in a simulator significantly increased secondary looking behavior[1] in both post-training simulator and on-road drives (Romoser & Fisher, 2009).
- Active practice was a necessary, but not sufficient, addition to classroom-style education for older drivers. Driving-specific feedback coupled with active practice were both necessary for positive transfer of training of classroom-style education to on-road driving (Lavallière et al., 2012).

[1] A secondary look is a look that occurs as or just after a driver begins to turn and is directed toward the oncoming traffic flow most likely to come into conflict with the driver's vehicle.

Expert Panel

Project staff convened a one-day meeting in Philadelphia, Pennsylvania, with 10 OTs, including some with specialty certifications in low vision and driving and community mobility, as well as professionals in driver rehabilitation and training, optometry, and neuro-optometric rehabilitation. The purpose of the meeting was to discuss changes in the VST program that might improve training outcomes or usability for OT generalists. The panel discussion informed the final version of the training protocol. Appendix A provides a list of panelists.

Project staff provided material describing the training program, its organization and content, and detailed descriptions and examples of the training exercises to panelists 2 weeks in advance of the meeting. The program developer led the panel discussion.

Following introductions, project staff described the VST program, explaining it was designed as a treatment intervention to be delivered one-on-one in an office setting by a generalist OT, who lacks the CDRS credential as well as the vehicle and liability insurance needed for on-road training, to healthy older drivers to help them keep driving safely. Such a program could be offered, for example, to residents in a continuing-care retirement community by a staff OT with an eye toward keeping residents safe on the road, or as a program in senior centers or other community settings where older adults congregate.

The discussion covered the content, format, and conduct of each session. A summary of the panel's discussion of three key topics the panel discussed is presented below.

Visual Conditions

Panelists first discussed conditions that could limit transfer of the training to on-road performance and whether drivers with these conditions should be excluded as participants. An optometrist suggested that binocular vision limitations, prevalent in the population of healthy older drivers, could limit training effectiveness. However, as the training program was designed for the older driver population, the sample should be representative of people with undiagnosed binocular vision limitations. On the other hand, intact color vision was necessary to participate in some of the exercises, so exclusion criteria retained color vision limitations.

In-Vehicle Practice

Next, panelists discussed a change in the program that was a substantial departure from its implementation described by Staplin et al. (2013). The protocol used by Staplin and colleagues included four office-based training sessions, each followed by an on-road element. The participant rode as a passenger and practiced the exercises learned in the office during the first three on-road sessions. During these sessions, the CDRS was in the back seat providing instruction, while a driving instructor drove the vehicle. In the fourth on-road session, the participant drove the vehicle, with the CDRS in the passenger seat providing instruction.

The panelists were adamant that for the training program to be administered by an OT generalist, it must not include in-vehicle sessions. The generalist OT panelists noted that they were not permitted to take clients out in vehicles, and it would be cost-prohibitive to hire driving schools to provide vehicles and driving instructors. Therefore, if the VST program included in-vehicle sessions, its impact on the population of older drivers would be limited to the few OT programs that could pay for the services of driving schools.

Regarding the question of transfer of training without in-vehicle sessions, a panelist pointed out that the homework assignments for each session included instructions for being active passengers by practicing the exercises taught in the office setting while riding. Several panelists indicated that active in-vehicle practice for homework was necessary to tie the clinic exercises to new scanning behavior on the road. For the program to be effective without the on-road sessions, participants had to complete homework assignments to increase the likelihood that the training would transfer to improved driving performance.

While panelists considered it unrealistic to expect participants to log their homework time, they noted the importance of ensuring that participants did the homework. One suggested contacting participants a few days after their appointments to ask if they had questions and to see how homework assignments were going. The program developer suggested beginning each session by asking participants how the homework went. This information could be coded by the OT conducting the training or by project staff when reviewing audiotapes of the training sessions.

Plain Language

Several OTs noted the importance of using non-technical language to ensure that participants could understand the training information. The group considered whether participants could be expected to understand terms such as "visual systems," "focal," and "peripheral." The group discussed wording that would accurately describe concepts using non-technical terms.

The program developer asked the panel if a description that compared the training to what athletes do to improve vision and performance was a useful analogy. Panelists agreed that the description was useful for explaining functional changes associated with aging, including visual scanning abilities, and how the training could improve older driver ability to use central and peripheral vision simultaneously to help them to be safer drivers.

Another panelist pointed out that most older adults want an overview of what they are going to do. Panelists stated that the administering OT could provide a syllabus at the beginning of the first session describing each session as well as the homework assignments and how long each would take.

Visual Scanning Training Study Methods

OMB and IRB Approval

This study and associated data collection received approval from the Office of Management and Budget (OMB Control No. 2127-0735) and the Advarra[2] Institutional Review Board (IRB).

Participant Recruitment

The study team sought 90 participants, divided equally among four age and sex categories (males 70 to 79 years old, males 80 and older, females 70 to 79, and females 80 and older). Inclusion criteria were age 70 or older; a current, valid driver's license; and intact color vision. Exclusion criteria included use of special/adaptive vehicle equipment and advice from a health care provider to limit or cease driving.

Researchers recruited participants through public solicitations in a Winston-Salem, North Carolina, continuing-care retirement center (CCRC). The CCRC administrator posted fliers around the facility (see Appendix B) and printed recruiting advertisements in the monthly newsletters to residents inviting them to attend a presentation describing the study. While CCRCs provide recruiting access to older adults who are active drivers, the residents are more likely than most community-dwelling older adults to be white, enjoy good health, and be financially secure. A team led by the training program developer made presentations to groups of residents. They provided an offer to follow up with those who wanted to learn more about the study and to sign up and complete the informed consent process with those who were interested. Potential participants completed color vision and binocular vision screens during the appointment. Researchers randomly assigned consented study participants to either the VST program (a series of four 1-hour, one-on-one training sessions) or to a control (placebo) activity for the same number of hours as the visual training protocol.

Participant incentives included two $100 gift cards each one given after the second and third driving evaluations, plus a professional driving evaluation (valued at approximately $350). The CDRS provided feedback on driving performance following the third evaluation only, to preclude confounding feedback and training effects on driving performance on the post-intervention evaluations.

Visual Scanning Training Program

The VST protocol was delivered by a generalist OT in one-on-one sessions in a clinical setting, targeting visual field expansion, simultaneous processing of multiple visual stimuli, and ocular skill (visual search routine) exercises. The occupational therapy-based VST program was developed by a CDRS from principles described in *Disciplined Attention* (Mills, 2005). The concept of "disciplined attention" describes the eyes and brain working together to process visual information, and it holds that visual scanning techniques can be used to achieve mastery over attention while performing complex activities such as driving. Through training in visual attention, it is suggested that a driver can learn to allocate attention in a way that may increase highway safety and reduce crash risk. Drivers also can develop poor visual habits such as target

[2] Advarra, headquartered in Columbia, Maryland, is a for-profit company providing institutional review boards (IRB), institutional biosafety committees, and research compliance consulting services for areas such as oncology, neurology, and commercial biosafety.

fixation, tunnel vision, and narrowed attention. These habits in combination with distractions, stress, and functional changes associated with aging may affect both what we see and how we react to what we see.

Mills (2005) outlined three critical visual processes for driving. The training program creator developed specific in-clinic exercises for each of these processes: (1) switching areas of attention, (2) expanding the field of view, and (3) using clean visual routines. Visual routines are scanning strategies specific to driving tasks such as changing lanes or navigating through intersections. Developing clean visual routines can guide visual attention to areas from which conflicts are most likely to emerge. This study addressed switching areas of attention through activities that required awareness to peripheral and focal, or central, vision. These activities were geared towards minimizing tunnel vision through gathering and analyzing a wider swath of visual information from the driving environment. Expanded field-of-view exercises were designed to help drivers recognize potential driving hazards earlier, allowing more time to act to avoid crashes. For example, a driver may be quicker to notice a vehicle approaching on an intersecting roadway, recognize that it may not stop, and respond in time to avoid a collision. Activities designed to enhance clean visual routines focused on where drivers should look when driving in contexts that have proven risky for older drivers, including lane changes, turns, and merges. These exercises trained a visual sequence that aimed to maximize safety during these maneuvers. All tasks in the VST protocol were tied to relevant roadway scenarios to enhance participant understanding and enable them to apply the new skills when driving.

A generalist OT who was trained by the CDRS who created the training curriculum administered the training to participants on an individual basis, over four 1-hour sessions. A framework of a "car" constructed from PVC piping provided the training platform. The trainee sat in the driver's position and the OT who administered the training sat in the front seat passenger position. Figure 1 and Figure 2 show the PVC car.

As participants completed each exercise, the OT scored performance using a 5-point scale. Scoring criteria were tailored to each exercise, with a score of "1" indicating that the task was discontinued early or the participant was unable to follow the task, and a score of "5" indicating the highest level of proficiency. The researchers summed the scores across the 25 exercises as a measure of mastery of the trained skills. In addition, following each of the first three sessions, the OT asked participants the following questions:

- *Do you believe the skills practiced in these exercises will influence your safety when driving?*
- *Which specific exercises/techniques were most helpful or did you like the most and why?*
- *Which specific exercises/techniques were most difficult, or did you not like and why?*

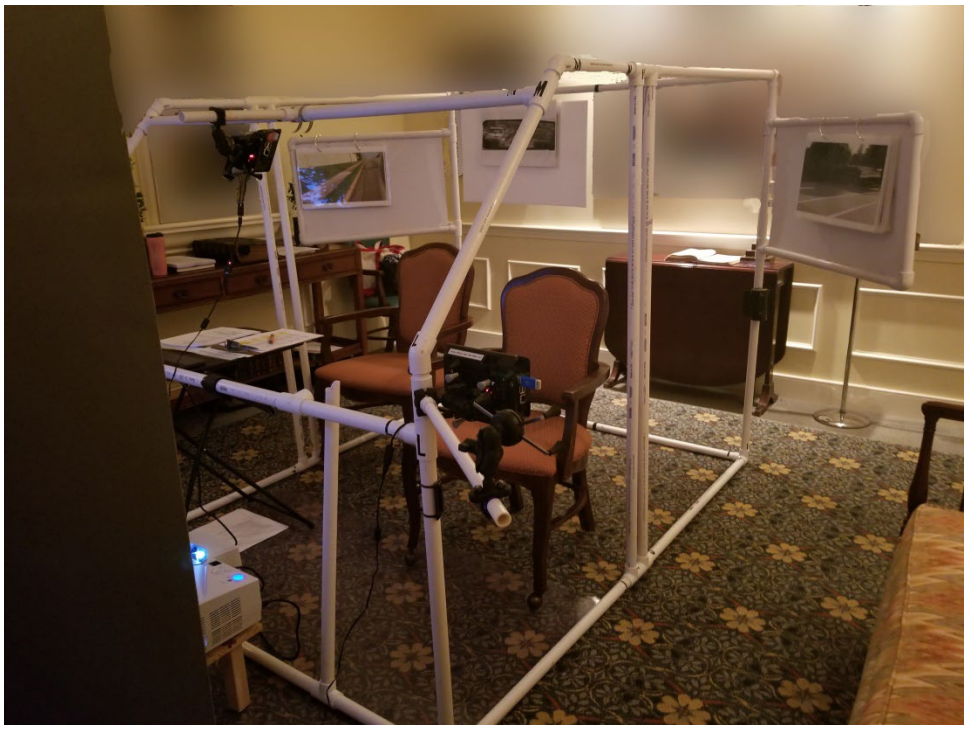

Figure 1. Front of PVC car viewed from the outside, showing driver and passenger positions and stimuli representing the roadway scene behind the vehicle

Figure 2. View of PVC car from the inside, with projection screen simulating forward roadway scene, and rearview and side mirror displays

Control Group Sessions

Participants assigned to the control group participated in four, 1-hour, small-group discussions relevant to older driver safety. Each group included 5 participants and was facilitated by an OT student from Winston-Salem University. Researchers provided the facilitator a discussion outline and supporting information for each session. The topics covered in the small group discussions were:

- the effects of medications (including drug interactions) on driving;
- how to use an online resource to check the effects of medications;
- how to access information about vehicle recalls on the NHTSA website, and information about driver assistive technologies on NHTSA, Insurance Institute for Highway Safety, and National Safety Council websites; and
- occupant protection features most important for preventing or reducing injury severity for older drivers and occupants.

On-Road Evaluations

A CDRS who was not the VST developer, and was "blind" to study-group assignment, conducted three, 1-hour on-road evaluations of each participant's driving performance over the course of the study. The three driving evaluations, conducted in a dual-brake sedan, were conducted before participants begin the training (or control) sessions, immediately after completion, and again three months after the intervention period.

Each of the three drives began and ended at the same location, but each used a different route that was comparable with respect to the environments (urban, suburban, rural), driving conditions (daylight, clear weather), road and traffic characteristics (residential, arterial, limited-access), and task demands (operational, tactical, and strategic) (see Table 1). While using three different routes reduced the possibility that a participant could learn specific features of a test route on an earlier evaluation that would bias a later evaluation, logistical challenges precluded the counterbalancing of all evaluations across all test routes, for all participants. Thus, the CDRS evaluated all participants on Route 1 at pre-intervention, on Route 2 immediately post-intervention, and on Route 3 for the evaluation three months later.

Table 1. Attributes of On-Road Evaluations

Attribute	Route 1 (Pre-Intervention)	Route 2 (Immediate Post-Intervention)	Route 3 (3-Month Post-Intervention)
Miles	14	14	11
Right turns	12	15	18
Signal Controlled	5	5	8
Uncontrolled	4	6	4
Stop sign	3	4	6
Left turns	16	15	16
Signal controlled	8	9	10
Uncontrolled	2	2	1
Stop sign	6	4	5
Lane Changes (minimum)	4	4	5
Merge onto Highway	2	2	2
Merge off of Highway	2	2	2
Parking	3	3	3
Backing	3	3	3
Roundabout	0	0	2

The CDRS scored participants' performance using the form shown in Appendix C. This score sheet grouped driving tasks into three skill sets: operational, tactical, and strategic. Operational skills pertained to vehicle control such as the ability to use the key, to adjust the seat and mirrors, and to control steering, accelerating, and braking. Examples of tactical skills included context-appropriate scanning, vehicle position, merges, and speed control. Strategic skills related to making safe driving decisions and included ability to follow directions, maintain conversation while driving and curtail conversation when necessary, and recognize and respond appropriately to hazards such as road construction and maintenance vehicles. The CDRS totaled driving errors recorded as sub scores for each of the three skill sets to calculate an overall driving error score. Higher scores (more errors) denoted worse performance.

Glance Direction and Duration

A camera mounted on the windshield along the base of the rearview mirror on the passenger side captured participants' visual scanning behaviors. After each driving evaluation, a data analyst viewed the driving videos and coded changes in head and eye position, documenting the frequency and duration of overt glances away from the forward view throughout the drive. Two researchers served as analysts; inter-rater reliability calculations checked the consistency of their coding results. The analysts coded glances toward each of five locations: (1) the left outside mirror/left side window, (2) the right outside mirror/right side window, (3) the inside rearview mirror, (4) the dashboard (downward glances), and (5) direct looks over the shoulder to the rear of the vehicle.

VST Feedback Questions

Following the final training session, participants in the VST group completed a brief questionnaire to determine whether they believed the training would help them to be a safer driver, whether they would recommend the training to friends or relatives, and what they would pay for such training (see Figure 3). Participants completed the questionnaire absent the trainer and placed their completed questionnaires in a sealed envelope.

Statement	**For each statement 1-4, circle your level of agreement (1=strongly disagree, to 5 = strongly agree).**				
1. The training activity I participated in will help me be a safer driver.	1 Strongly Disagree	2	3	4	5 Strongly Agree
2. I would recommend this training activity to a friend or relative.	1 Strongly Disagree	2	3	4	5 Strongly Agree
3. If I started this training activity on my own, outside of any research study, I would have completed all of my training sessions.	1 Strongly Disagree	2	3	4	5 Strongly Agree
4. I would pay for this training.	1 Strongly Disagree	2	3	4	5 Strongly Agree
5. I would pay up to $_____ for this training if I received a 10% discount on my car insurance.					
6. I would pay up to $_____ for this training whether or not I received a discount on my car insurance.					

Figure 3. Training feedback questions for VST protocol

Results

Sample Demographics

Table 2 displays demographics for the 89 participants who completed the study.

Table 2. Sample Demographics by Study Group

Group	Age	*n*	Range	*M* (*SD*)
Treatment	70-79	23 (7 males)	70-79	75.1 (2.41)
	80+	23 (11 males)	80-92	85.6 (2.91)
Control	70-79	21 (6 males)	70-79	74.5 (2.39)
	80+	22 (11 males)	80-100	86.2 (4.69)
Total		89 (35 males)	70-100	80.5 (6.49)

VST Exercise Feedback

All but one participant indicated that the skills practiced in the exercises would influence their safety when driving. This one participant indicating otherwise stated that the Session 1 exercises would "not really" influence their driving safety.

Table 3 shows participants' responses regarding the exercises deemed most helpful/most liked and most difficult/least liked, for Sessions 1-3. Session 4 was a wrap-up incorporating the lessons learned during the first three sessions; therefore, Session 4 responses were not included in Table 3. Percentages may not add up to 100% as participants may have noted multiple exercises for each question, or did not respond at all. Often, the exercises that were selected as most helpful/most liked were also deemed the most difficult; many participants indicated that while the driving videos were the most challenging, they were also the most beneficial. Three participants indicated that the driving video in Session 1 made them dizzy, and one of these felt nauseated and had to stop the exercise.

Scored Performance on VST Exercises

Table 4 summarizes partcipant mastery of skills covered in the 25 exercises included in the scanning training protocol. Many exercises incorporated three attempts; the OT recorded scores for all three attempts and calculated an average score, which was used in this analysis. The highest possible total score was 125 (5 points for each of 25 exercises). Across all participants, the total score ranged from 49.5 to 124.5, and it averaged 100.6 (SD=18.4). Descriptions of the exercises can be found in Appendix B of Staplin et al., 2013.

Table 3. Exercises by Session Deemed Most Liked/Most Helpful and Most Difficult/Least Liked

Exercise	Most Helpful/ Most Liked (% of Sample)	Most Difficult/ Least Liked (% of Sample)
Session 1		
1. Divided Attention With Target (Puppets)	12%	3%
2. Laser Tag	7%	0%
3. Rabbit Chase	31%	0%
4. Divided Attention With Signs on Road Scenes & Mirrors	24%	15%
5. Divided Attention Video With Signs on Road Scenes & Mirrors	48%	50%
All Were Helpful	19%	---
None Disliked or Too Difficult	----	43%
Session 2		
1. Peripheral Stop Signs	7%	0%
2. Peripheral Expansion Chart	14%	0%
3. Swinging Balls With Central Task	21%	12%
4. Peripheral Ball Toss	9%	9%
5. Ball to Wall Throwing and Catching Exercise	2%	9%
6. Juggling One Bean Bag	9%	30%
7. Rabbits With Central Image	26%	16%
8. The Bradley	0%	2%
All Were Helpful	9%	---
None Disliked or Too Difficult	---	28%
Session 3		
1. Visual Sweeping	20%	0%
2. Smith System	18%	0%
3. Visual Routine for Lane Changes & Merges – Still Pictures	8%	5%
4. Visual Routine for Lane Changes & Merges – Video	15%	5%
5. Visual Routine for a Turn – Still Pictures	5%	2%
6. Visual Routine for a Turn – Video	20%	5%
7. Visual Routine for Backing	13%	37%
All Were Helpful	18%	----
None Disliked or Too Difficult	----	34%

Table 4. Summary of Scored Performance on VST Exercises

Exercise	n	Range	Mean (SD)
Divided Attention w/Target	45	2-5	4.7 (0.81)
Laser Tag	45	2-5	4.4 (0.96)
Rabbit Chase	45	3-5	4.8 (0.46)
Divided Attention w/ Signs on Road Scenes & Mirrors	45	2-5	3.8 (0.86)
Divided Attention Video w/ Signs on Road Scenes & Mirrors	45	2-5	3.8 (0.91)
Peripheral Stop Signs	45	1-5	3.9 (1.22)
Peripheral Expansion Chart	45	1-5	3.6 (1.46)
Swinging Balls w/ Central Task	45	1.3-5	4.1 (1.11)
Peripheral Ball Toss	45	1.5-5	3.7 (1.11)
Ball to Wall Throwing & Catching Exercise	45	1-5	3.7 (1.23)
Juggling One Bean Bag	45	1-5	3.1 (1.33)
Rabbits w/ Central Image	45	1-5	3.2 (1.09)
The Bradley	40	1-5	3.7 (1.19)
Visual Sweeping	45	2-5	4.4 (0.83)
Smith System	45	2-5	4.4 (0.91)
Visual Routines for Lane Changes & Merges - Still Pictures	45	1-5	4.4 (1.02)
Visual Routines for Lane Changes & Merges - Video	45	1-5	4.4 (1.15)
Visual Routine for a Turn - Still Pictures	45	1-5	4.5 (1.02)
Visual Routine for a Turn - Video	43	2.5-5	4.9 (0.46)
Visual Routine for Backing	43	1-5	4.4 (0.99)
Switching Attention Warmup - Various Road Scenes	45	2-5	4.1 (0.82)
Peripheral Expansion Chart and Stop Signs	45	1-5	3.6 (1.15)
Smith System Video With Visual Sweeping	45	2-5	4.2 (0.78)
Visual Routines for Backing and Lane Changes - Still Images	44	1-5	4.2 (1.11)
Visual Routines for Intersection Management With Video	44	1-5	4.6 (0.86)
Total Exercises Completed	45	21-25	24.6(0.86)
Total Score (sum)	45	49.5-124.5	100.6 (18.36)

Exercise	n	Range	Mean (SD)
Average Score	45	2.2-5.0	4.1 (0.70)
Min Score	45	1.0-4.5	2.2 (1.04)
Max Score	45	4.0-6.0	5.0 (0.27)
SD	45	3.7-4.5	4.2 (0.18)

Several participants spontaneously commented on medical or functional conditions that may have contributed to their having difficulty with certain exercises. These included:

- English not first language;
- Nystagmus (reduced vision and depth percention);
- Stroke – 3 participants with different effects;
- Macular hole (reduced central vision);
- Glaucoma – 3 participants (reduced vision);
- Cataract (reduced contrast sensitivity);
- Macular scar (blurred or distorted central vision);
- Balance issues and fear of falling (difficulty with ball toss, bean bag, Bradley walk); and
- Limited hearing (difficulty understanding instructions).

The OT also discussed the homework assignments with participants and noted whether they completed the assigned homework. Of the 46 participants in the treatment group, 38 did at least some homework while 8 did none.

VST Feedback Questions

Table 5 summarizes responses to the five questions posed to participants as shown in Figure 3. Most participants found the training valuable, although they were less likely to report that they would be willing to pay for it. One participant commented that willingness to pay would be higher if the course was required to avoid license suspension or revocation. Another participant commented that in an unstructured, self-motivated situation, they might have allowed other activities to draw them away from course completion, but that being part of a group in a study was motivating, as was having a specific time to participate each week.

Table 5. VST Feedback

Statement	n	Range	Mean	SD
The training activity I participated in will help me be a safer driver	45	1-5	4.4	1.1
I would recommend this training activity to a friend or relative	45	1-5	4.4	1.2
If I started this training activity on my own, outside of any research study, I would have completed all of my training sessions	45	1-5	4.2	1.0
I would pay for this training	45	1-5	3.4	1.1
I would pay up to $ _____ for this training if I received a 10% discount on my car insurance.	43	$0.00-$500.00	$96.86	$98.20
I would pay up to $ ___ for this training whether or not I received a discount on my car insurance.	38	$0.00-$500.00	$85.66	$101.43

On-Road Driving Performance

Road Test Performance at Pre-Intervention (Drive 1)

Table 6 presents summary statistics, by group, for the number of road test points scored off (error score) for each driving skill subset and the total road test error score during the pre-intervention drive (Drive 1). The higher the score, the poorer the performance. T-tests conducted on the pre-intervention road test scores indicated that there were no statistically significant differences at the 0.05-level between the mean treatment and control group error scores.

Table 6. Road Test Error Scores by Group at Pre-Intervention (Drive 1)

	Treatment Group (N=46)		Control Group (N=43)		Difference
Points Off	Mean (SD)	Range	Mean (SD)	Range	in Means
Operational Skills	0.5 (1.80)	0-11	0.8 (3.36)	0-21	-0.34
Tactical Skills	48.1 (35.38)	11-147	56.7 (43.30)	8-188	-8.57
Strategic Skills	4.5 (6.60)	0-25	3.4 (4.19)	0-15	1.09
Overall	53.1 (38.00)	11-152	60.9 (45.94)	8-199	-7.82

Group Road Test Performance at Immediate Post-Intervention (Drive 2)

Table 7 compares road test scores during the immediate post-intervention drive (Drive 2). Comparing the immediate post-intervention error scores for the treatment to the control groups appears to indicate that the treatment group made more errors than the control group. However, two-sample t-tests found no statistically significant differences at the 0.05-level between groups on any error score. Similarly, the comparison of immediate post-intervention to pre-intervention error scores for the treatment group appears to indicate that the drivers made more errors after the intervention. However, t-tests using the change scores (i.e., the difference between Drive 2 and Drive 1 error scores) also showed no statistically signficant differences between groups.

Table 7. Road Test Error Scores by Group at Immediate Post-Intervention

Drive 2 Road Test Scores	Treatment Drive 2 Mean	Control Drive 2 Mean	Difference Treatment - Control Drive 2 Mean	Treatment Drive 1 Mean	Difference Treatment Drive 2 - Drive 1 Mean
Operational Skills	0.6	0.6	0.02	0.5	0.08
Tactical Skills	50.5	48.3	2.22	48.1	2.35
Strategic Skills	3.8	0.9	2.87	4.5	-0.66
Overall	54.8	49.7	5.11	53.1	1.76

Appendix D, Table D-1 presents summary statistics, by group, for the road test error score for each driving skill subset and the total error score during the immediate post-intervention drive.

Road Test Performance at 3-Months Post-Intervention (Drive 3)

Table 8 compares road test scores at 3 months after intervention (Drive 3). Comparing the 3-months post intervention error scores for the treatment and control groups appears to indicate that the treatment group had fewer errors, mainly driven by fewer tactical errors. However, two-sample t-tests found no statistically significant differences at the 0.05-level between groups on any skill subset error score or the total road test error score. Similarly the comparison of 3-months post intervention and pre-intervention suggests that drivers had fewer errors after treatment, but t-tests using the change scores showed no statistically significant differences between groups. Appendix D, Table D-2, presents summary statistics, by group, for the road test error score for each driving skill subset and the total error score during the 3-month post-intervention drive.

Table 8. Road Test Error Scores by Group at 3-Months Post-Intervention

Drive 3 Road Test Scores	Treatment Drive 3 Mean	Control Drive 3 Mean	Difference Treatment - Control Drive 3 Mean	Treatment Drive 1 Mean	Difference Treatment Drive 3 - Drive 1 Mean
Operational Skills	0.5	0.6	-0.02	0.5	0.04
Tactical Skills	42.2	48.3	-6.04	48.1	-5.91
Strategic Skills	1.5	0.9	0.59	4.5	-2.94
Overall	44.3	49.7	-5.46	53.1	-8.81

The road test form provided a metric for converting points to a letter grade: 0-24 points = A; 25-49 = B; 50-75 = C; 76-99 = D; and 100+ = F (with an automatic fail and 100 points for running a stop sign or red light). Table 9 presents the distribution of road test grades by group and drive, and Figure 4 presents road test performance categorized as passing, marginal, and fail. Appendix E presents the total number of treatment group participants who made each error, the total error score across participants for each task, and totals by subscore, for Drives 1, 2, and 3. Appendix F presents control group error performance on Drives 1, 2, and 3.

Table 9. Road Test Grade by Group and Drive

Road Test Grade	Treatment Group			Control Group		
	Drive 1	Drive 2	Drive 3	Drive 1	Drive 2	Drive 3
A: Pass with no restrictions	10 (22%)	9 (19%)	15 (33%)	9 (21%)	6 (14%)	13 (30%)
B: Pass with recommendations	20 (43%)	18 (39%)	17 (37%)	13 (30%)	16 (37%)	12 (28%)
C: Marginal with restrictions or training	5 (11%)	10 (22%)	7 (15%)	10 (23%)	12 (28%)	9 (21%)
D: Fail	6 (13%)	4 (9%)	4 (9%)	3 (7%)	3 (7%)	3 (7%)
F: Fail (100+ points, run red light or stop sign)	5 (11%)	5 (11%)	3 (6%)	8 (19%)	6 (14%)	6 (14%)
Total	46 (100%)	46 (100%)	46 (100%)	43 (100%)	43 (100%)	43 (100%)

Glance Direction and Duration

The scanning behaviors summarized below were manually coded from in-vehicle video recorded during the test drives. One researcher coded the Drive 1 and Drive 2 videos for all participants; a different researcher coded the Drive 3 videos. To check inter-coder reliability, the first researcher also coded the Drive 3 videos for three participants—one each at the beginning, middle, and end, respectively, of the 89-participant sequence of test drives. This check showed a concordance between coders, averaged across these participants, of *96.1%* for the *frequency* of glances away from the forward orientation and *88.5%* for the *duration* of glances away from the forward orientation. Drive 1 video data for one treatment and one control participant were corrupt, resulting in an analysis sample of 45 treatment group and 42 control group participants.

Scanning Behavior at Pre-Intervention (Drive 1)

Table 10 presents summary statistics, by group, for the frequency of looks per minute at each of the five coded locations, and the total looks per minute away from the forward direction during the pre-intervention drive (Drive 1). Table 11 summarizes glance duration (operationalized as proportion of the drive time) for each location, as well as the total proportion of the drive that participants glanced away from forward. T-tests conducted on both the frequency and duration of total glances away from forward at pre-intervention indicated no significant differences (at the 0.05 level) between the treatment and control groups.

Table 10. Drive 1 - Glances per Minute by Group and Direction

	Glances per Minute				
	Treatment		Control		Difference
Glance direction	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**in Means**
Back (direct look)	0.1 (0.12)	0.0-0.6	0.1 (1.10)	0.0-0.5	0.0
Down (toward speedometer)	1.2 (0.64)	0.2-2.6	1.0 (0.70)	0.2-3.4	0.2
Left (mirror, window)	4.4 (1.48)	1.9-8.3	4.2 (1.40)	2.2-9.0	0.2
Inside rearview mirror	1.0 (0.73)	0.1-3.5	1.2 (0.78)	0.2-4.4	-0.2
Right (mirror, window)	3.1 (1.13)	1.4-7.2	2.8 (1.14)	1.3-6.4	0.3
Total away from forward	**9.8 (2.66)**	**4.7-17.7**	**9.2 (3.04)**	**5.0-19.0**	**0.6**

Table 11. Drive 1 - Glance Duration by Group and Direction

	Glance Duration – Percentage of Drive				
	Treatment		Control		Difference
Glance direction	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**in Means**
Back (direct look)	0.3 (0.34)	0.0-1.4	0.3 (0.28)	0.0-0.5	0.28
Down (toward speedometer)	3.4 (1.62)	0.8-7.0	3.2 (1.69)	1.1-7.9	1.69
Left (mirror, window)	11.4 (2.83)	6.2-22.2	11.5 (2.35)	7.9-19.2	2.35
Inside rearview mirror	1.3 (0.94)	0.1-4.6	1.4 (0.69)	0.3-3.7	0.69
Right (mirror, window)	6.1 (1.13)	2.1-10.6	5.9 (1.75)	2.3-10.5	1.75
Total away from forward	**22.5 (4.08)**	**14.7-33.80**	**22.2 (3.56)**	**14.5-33.9**	**3.56**

Scanning Behavior at Immediate Post-Intervention (Drive 2)

T-tests conducted on both the frequency and duration of total glances away from forward at pre-intervention indicated no significant differences between the treatment and control group. Similarly, T-tests using the change scores for both frequency and duration of total glances away from forward (i.e., the difference between Drive 2 and Drive 1 totals) also showed no signficant difference between groups. Table 12 presents summary statistics, by group, for the frequency of glances per minute at each of the five locations, and the total glances per minute away from the forward direction during the immediate post-intervention drive. Appendix G, Table G-2 summarizes glance duration for each location, as well as the total proportion of the drive that glances were away from forward.

Table 12. Drive 2 - Mean Glances per Minute Away From Forward by Group and Direction

Drive 2 Glance Frequency	Treatment Drive 2 Mean	Control Drive 2 Mean	Difference Treatment - Control Drive 2 Mean	Treatment Drive 1 Mean	Difference Treatment Drive 2 - Drive 1 Mean
Back (direct look)	0.18	0.11	0.07	0.11	0.07
Down (speedometer)	0.73	0.66	0.07	1.16	-0.43
Left (mirror, window)	5.25	5.15	0.1	4.42	0.83
Inside rearview mirror	1.22	1.01	0.21	1.02	0.2
Right (mirror, window)	3.82	3.67	0.15	3.06	0.76
Total not forward	**11.21**	**10.58**	**0.63**	**9.77**	**1.44**

Scanning Behavior at 3-Months Post-Intervention (Drive 3)

T-tests conducted on both the frequency and duration of total glances away from forward at pre-intervention indicated no significant differences between the treatment and control group. Similarly, T-tests using the change scores for both frequency and duration of total glances away from forward (i.e., the difference between Drive 3 and Drive 1 totals) also showed no signficant difference between groups. Table 13 presents summary statistics, by group, for the frequency of glances per minute at each of the five locations, and the total glances per minute away from the forward direction during the 3-month post-intervention drive. Appendix G, Table G-4 summarizes glance duration for each location, as well as the total proportion of the drive that glances were away from forward.

Table 13. Drive 3 - Mean Glances per Minute Away From Forward by Group and Direction

Drive 3 Glance Frequency	Treatment Drive 3 Mean	Control Drive 3 Mean	Difference Treatment - Control Drive 3 Mean	Treatment Drive 1 Mean	Difference Treatment Drive 3 - Drive 1 Mean
Back (direct look)	0.20	0.17	0.03	**0.11**	0.09
Down (speedometer)	0.95	0.86	0.09	1.16	-0.21
Left (mirror, window)	5.11	4.87	0.24	4.42	0.69
Inside rearview mirror	0.75	0.59	0.16	1.02	-0.27
Right (mirror, window)	4.80	4.66	0.14	3.06	1.74
Total not forward	**11.80**	**11.15**	**0.65**	**9.77**	**2.03**

Discussion and Conclusions

The primary objective of this study was to validate the preliminary but encouraging findings for a VST intervention reported by Staplin et al. (2013). This study modified the previous training protocol by dropping an in-vehicle training component. An expert panel suggested the modification would be essential to maximize the intervention's potential for widespread use by generalist OTs, who would unlikely have access to a vehicle to use for this purpose. The research team recruited a sample of 90 active drivers ranging from 70 to 100 years old, with the cooperation and support of the intervention site, a CCRC near Winston-Salem, North Carolina. Measures of training effectiveness included road test scores and measures of glance behaviors. Questionnaire responses provided insights regarding participants' perceptions of the program's value.

The performance measures did not demonstrate improvement in either road test scores or scanning activity relative to the control group as hypothesized. Questionnaire responses indicated that those who completed the training program generally affirmed that what they learned through the exercises would help them drive more safely and that they would recommend the training to friends and relatives. They considered the training valuable—in fact, a plurality indicated that they would be willing to pay up to $50 for the program, *with or without* an auto insurance discount.

Given the sound theoretical foundation and solid construct validity of this approach to enhance drivers' visual scanning behavior, buttressed by the positive perceptions of training program value by study participants, these results demand a critical examination of the methodology in this investigation for possible shortcomings. Three possible weaknesses were identified.

First, participants' transfer of what they learned in the training exercises to actual driving experience may have been hampered by the removal of the behind-the-wheel component in the training protocol. The efficacy of classroom driver improvement courses is known to increase when supplemented with behind-the-wheel instruction; this was demonstrated in the precursor study (Staplin et al., 2013). However, the cost and liability associated with on-road training sessions effectively ruled out this option for any downstream application by generalist OTs. The attention to detail when designing the training platform—for example, incorporating dynamic, correct-perspective video displays for each of the rearview "mirrors" mounted on the PVC "car"—was intended to provide necessary contextual information; but, these efforts may have been insufficient. Further, many participants reported completing only some of the homework assignments that were designed to reinforce the training sessions; 20% did none of the homework. This failure may have limited the transfer from training exercises to driving behaviors.

Next, a driver's scanning behavior during an on-road evaluation by a driver rehabilitation specialist is subject to certain "demand characteristics" as the driver listens to and interacts with the evaluator. In addition to providing verbal instructions for route navigation, such dialogue is often continuous throughout the drive—an intentional part of the evaluation to increase difficulty of the driving task to reveal any limitations related to divided attention deficits. Thus, the indeterminate outcomes for the driver performance measures do not conclusively rule out benefits to participants when driving independently.

This points to what may be the most significant limitation in the experimental design for this study: applying a measure of effectiveness that relied on snapshots of driver behavior, obtained

under conditions subject to the potentially-confounding influences noted above, rather than using naturalistic data collection methods to monitor changes in scanning activity over time as participants drove their own vehicles.

In summary, the present study may be viewed as a beta test that revealed both strengths and weaknesses of the VST program. A curriculum was developed and delivered by a generalist OT to older drivers, who felt the training program would help them drive more safely. While the lack of evidence of training effectiveness forestalls support for this tool to be widely implemented, it also points to opportunities both for continuing research and for innovations in clinical practice.

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Appendix A: Expert Panelists

Gayle B. Agar, **OTRL, CDI, CDRS,** who specializes in clients with low vision, most specifically people using bioptic telescopic lens systems.

Dan Allison, Jr., MS, OTR/L, ATP, CDRS, the current president of ADED (The Association for Driver Rehabilitation Specialists)[3] and whose practice focuses on disabled driver rehabilitation.

Barco, Peggy, OTD, OTR/L, SCDCM, CDRS, FAOTA, whose clinical interests include cognitive assessment and intervention, awareness deficits after brain injury, driving and community mobility, and driving performance in older adults with various medical impairments.

Elizabeth (Beth) Barstow, **PhD, OTR/L, SCLV, FAOTA,** a clinician who focuses on low vision and adult rehabilitation services.

Janet Berthiaume, **OTR/L, DRS, FNORA,** who focuses her career on improving visual dysfunction in rehabilitation clients.

Laura M. Caron-Parker, OTR/L, who is recognized with clinical expertise and leadership in the areas of wellness, low vision, dementia, community asset mapping and health literacy. In her current role as V2U Clinical Director, she has significant involvement in clinical practice development, helping occupational therapy clinicians expand their scope of practice across the OT Practice Framework Domains.

Elizabeth Green, OTR/L, CDRS, CAE, who is currently the executive director of ADED (The Association for Driver Rehabilitation Specialists).

Barry Kavanaugh, **OD, FAAO, FCOVD,** a neuro-optometrist who carries out visual enhancement strategies with his clients, and has double fellowships in the American Academy of Optometry and the College of Optometrists in Vision Development.

Elin Schold-Davis, OTR/L, CDRS, who is the Older Driver Initiative project coordinator for the American Occupational Therapy, whose initiative have been building awareness of occupational therapy's role in senior safe mobility while increasing the capacity of occupational therapy programs to address driving as an instrumental activity of daily living.

Cheryl L. Zemina, **OTR/L,** who specializes in low vision, and is responsible for all financial operations, staffing and orientation, resident education, program development/ implementation and supervision of rehab services in numerous locations, including SNF, assisted living facilities and an independent living facility and a home health agency.

[3] Founded in 1977 as the Association for Driver Educators for the Disabled (ADED), the organization changed its name in 1997 to ADED (The Association for Driver Rehabilitation Specialists)

Appendix B: Recruitment Poster

Volunteers Needed for
Paid Driving Study at Arbor Acres

Arbor Acres is the site of a research study is to learn whether two training programs designed to improve older driver safety are effective. This study will compare the on-road driving performance of two groups of individuals age 70 and older: (1) drivers who complete training to improve their visual scanning, and (2) drivers who complete small group information sessions about safe driving practices.

The results of your driving evaluation will not be shared with the Department of Motor Vehicles and your participation in this study will not affect your license status.

If you are age 70 or older, please consider volunteering for this important study. If you qualify to participate and complete all study activities, **you will be paid $200**.

To learn more about the research study and what you as a participant will be asked to do, please attend the following information session hosted by members of the research team:

Event:	**Driving Study Inquiry Meeting**
Date:	**Thursday, June 6**
Time:	**10:00am – 11:00 am**
Location:	**Gathering Place**

We look forward to seeing you!

This study is funded by the U.S.DOT, National Highway Traffic Safety Administration (NHTSA)

Appendix C: Driving Evaluation Form

Subject #_____

Weather Conditions: ___Sunny ___Overcast ___Rainy ___Windy ___Other: _____

Behind the Wheel Scoring Sheet:

Visual Scanning Training for Older Drivers-OMB Control Number: 2127-0735

ROUTE One Winston Salem – Arbor Acres 14 MILES

Operational Skills	*Tally*	*Total*
Independent access to vehicle (1)	_____	_____
Negotiation of driver door (1)	_____	_____
Seat adjustment (3)	_____	_____
Wheel adjustment (3)	_____	_____
Mirror adjustment (3)	_____	_____
Fastens seat belt (3)	_____	_____
Ignition Control (3)	_____	_____
Gear selection appropriate (3)	_____	_____
Brake pedal use (3)	_____	_____
Accelerator pedal use (3)	_____	_____
Steering (5)	_____	_____
Signal ability (5)	_____	_____
Adjusts Heating and Air/Radio if needed(5)	_____	_____
Turn Signal/Lights/Wiper/Cruise controls used if necessary (5)	_____	_____
Parking brake used if necessary (5)	_____	_____
Operational Points off	_____	_____

Comments:

Tactical Skills	*Tally*	*Total*
Visual Skills:		
Fails to scan environment/tunnel vision (10)	_____	_____
Looks but doesn't see (10)	_____	_____
Awareness of signage (5)	_____	_____
Fails to check speedometer(5)	_____	_____

NOTES:

Vehicle Position:		
Lane maintenance/centered position (5)	_____	_____
Drives in proper lane (5)	_____	_____
Follow distance/Lateral Cushion (5)	_____	_____
Stopping position (5)	_____	_____
Response to other traffic (5)	_____	_____

NOTES:

Subject # _____

Intersections/Turns *(Right)*

Check Traffic (5)	_____	_____
Fails to signal (3)	_____	_____
Proper Lane (5)	_____	_____
Speed (3)	_____	_____
Safe gap selection/yield (10)	_____	_____
Fails to make complete stop, obvious roll but safe (5)	_____	_____
Fails to make complete stop, obvious roll and risky (10)	_____	_____
Fails to make complete stop (3)	_____	_____
(Very near stop but vehicle does not settle back)		
Runs red light (100)	_____	_____

Location of above infraction: 12 Right Turns

___Right at first stop sign in Arbor Acres toward gate house
___Right onto Northwest Blvd (quick acquired right turn lane; school zone, pedestrian cross walks)
___Right on Hawthorne
___ Right on Country Club (Stop Sign at T intersection)
___Right on Arbor Road
___Right on Greenbrier Road
___Right On Coliseum (right turn lane. Light protected turn)
___Right on University
___Right into CVS Parking lot
___Hard Right to opposite side to park at CVS
___Right on University (Yield Sign)
___Right on 25th

5 – Light Controlled
4 – Moving
3 - stopped

Subject # _____

Lane changes:

Fails to signal (5)	_____	_____
Fails to use mirrors to check traffic (5)	_____	_____
Fails to perform necessary blind spot checks (5)	_____	_____
Position (3)	_____	_____
Speed (3)	_____	_____
Lane (5)	_____	_____
Safe gap selection/yield (10)	_____	_____

___ Lane change Left on 421 — 4 lane changes (minimum)
___ Lane change right on 421
___ Lane change Left in prep for left turn on Hawthorne
___ Lane change right after returning to Silas Creek from Hawthorne before merging onto 421 S/40E
___ (may have other lane changes if not assuming turn lanes readily)

Merges on/off limited access hwy

Judgment of space (5)	_____	_____
Signaling (5)	_____	_____
Speed regulation (5)	_____	_____
Visual scanning/Blind spot (5)	_____	_____

Location of above infraction: — 2 merges on and 2 merges off highway
___Onto 421 N at 1st Street
___Off of 421 at exit 2A Silas Creek
___Onto 421 S (Business 40 E)
___Off of at Knollwood Road

Vehicle Handling:

Judge and regulate speed (5)	_____	_____
Smooth steering (5)	_____	_____
Smooth accelerator (5)	_____	_____
Smooth braking(5)	_____	_____
Appropriate use of signals (5)	_____	_____
Response to traffic signal (5)	_____	_____
Fails to make complete stop, obvious roll but safe (5)	_____	_____
Fails to make complete stop, obvious roll and risky (10)	_____	_____
Parking : Approach (3)	_____	_____
Position (3)	_____	_____
Speed (3)	_____	_____
Backing: Check Traffic (5)	_____	_____
Position (3)	_____	_____
Speed (3)	_____	_____
Safe/yield (10)	_____	_____

Location of above infraction (parking and backing): — 3 occasions for parking and backing
___Leaving Arbor Acres (backing)
___At Wells Fargo
___At CVS
___Returning to Arbor Acres (parking)

Subject # _____

3-pt turn around (5)	_____	_____
U-Turn	_____	_____
Position (3)	_____	_____
Speed (3)	_____	_____
Safe/yield (10)	_____	_____
Traffic Circle at Alamance Crossing (5)	_____	_____
Tactical Points Off	_____	_____

Comments:

Strategic Skills	*Tally*	*Total*
Correct and safe decisions		
Residential (5)	_____	_____
City (5)	_____	_____
Limited access hwy (5)	_____	_____
Route planning(5)	_____	_____
Route logically sequenced (5)	_____	_____
Remembers and executes the route in the preplanned order (5)	_____	_____
Maintains/regulates conversation appropriately (5)	_____	_____
Problems following rules of the road (5)	_____	_____
Fails to make decisions in advance of Maneuvers (5)	_____	_____
Separates hazards (5)	_____	_____
Fails to observe cues from other road users (5)	_____	_____
Fails to anticipate(5)	_____	_____
Decreased Processing speed(5)	_____	_____
Impaired following directions (5)	_____	_____
Strategic Points Off	_____	_____

Comments:

SCORING: TOTAL POINTS OFF= (A – 0-24; pass with no restrictions), (B – 25-49; pass with recommendations), (C – 50-75; marginal with restrictions; marginal with training), (D – 76-99; Fail), (F – 100 up; Fail)

A vertical mark beside an item indicates points off (tally). The point value of each item is in parenthesis. Each item may have several vertical marks beside it representing the errors that were committed more than one time. Multiply the number of vertical marks times the point value in parenthesis to get the Points Off for that item (total).

100 or more Total Points Off is a failure.

TOTAL ROAD POINTS _____ **Score:**

Feedback provided to Participant:

Appendix D: Road Test Error Scores at Immediate and 3-Months Post-Intervention

Table D-1. Road Test Error Scores by Group at Immediate Post-Intervention

Drive 2 Road Test Subscore	Study Group							
	Treatment Group				Control Group			
	Average	Median	Range	SD	Average	Median	Range	SD
Operational Skills	0.58	0	0-9	1.82	0.47	0	0-5	1.20
Tactical Skills	50.48	42	13-269	42.29	53.26	47	0-159	35.29
Strategic Skills	3.80	0	0-20	5.69	3.14	0	0-25	4.76
Overall	54.85	45	13-285	44.84	56.86	49	5-159	36.40

Table D-2. Road Test Error Scores by Group at 3-Months Post-Intervention

Drive 3 Road Test Subscore	Study Group							
	Treatment Group				Control Group			
	Average	Median	Range	SD	Average	Median	Range	SD
Operational Skills	0.54	0	0-6	1.49	0.56	0	0-15	2.38
Tactical Skills	42.22	31	3-155	34.15	48.26	34	5-160	37.52
Strategic Skills	1.52	0	0-10	2.76	0.93	0	0-10	2.25
Overall	44.28	33.5	3-160	34.91	49.74	36	5-165	39.04

Appendix E: Treatment Group Error Summary by Drive

TREATMENT GROUP (N=46)	**Pre-Intervention (Drive 1)**		**Immediate Post-Intervention (Drive 2)**		**3-Month Post-Intervention (Drive 3)**	
Operational Skills	**Number of Participants With Errors**	***Total Error Sum***	**Number of Participants With Errors**	***Total Error Sum***	**Number of Participants With Errors**	***Total Error Sum***
Independent access to vehicle (1)	0	0	0	0	0	0
Negotiation of driver door (1)	0	0	0	0	0	0
Seat adjustment (3)	1	3	0	0	0	0
Wheel adjustment (3)	0	0	0	0	0	0
Mirror adjustment (3)	0	0	0	0	0	0
Fastens seat belt (3)	0	0	0	0	1	3
Ignition control (3)	0	0	0	0	0	0
Gear selection appropriate (3)	3	9	1	6	1	3
Brake pedal use (3)	1	3	3	15	1	3
Accelerator pedal use (3)	1	3	0	0	1	6
Steering (5)	0	0	0	0	0	0
Signal ability (5)	0	0	0	0	0	0
Adjusts heating and air/radio if needed (5)	0	0	0	0	0	0
Turn signal/lights/wiper/cruise controls used if necessary (5)	0	0	1	5	2	10
Parking brake used if necessary (5)	1	5	0	0	0	0
Operational Points off	***5***	***23***	***5***	***26***	***6***	***25***

Tactical Skills	**Pre-Intervention (Drive 1)**		**Immediate Post-Intervention (Drive 2)**		**3-Month Post-Intervention (Drive 3)**	
	Number of Participants With Errors	***Total Error Sum***	**Number of Participants With Errors**	***Total Error Sum***	**Number of Participants With Errors**	***Total Error Sum***
Visual Skills:						
Fails to scan environment/tunnel vision (10)	0	0	2	20	0	0
Awareness of signage (5)	26	195	17	125	14	105
Attention deficit – "looked but didn't see" (10)	0	0	0	0	1	10
Fails to check speedometer (5)	13	100	4	35	12	80
Runs red going straight	0	0	0	0	0	0
Vehicle Position:						
Lane maintenance/centered position (5)	27	290	15	125	10	70
Drives in proper lane (5)	2	10	0	0	0	0
Follow distance/Lateral Cushion (5)	0	0	0	0	0	0
Stopping position (5)	0	0	3	15	1	10
Response to other traffic (5)	3	15	5	30	7	35
Intersections/turns *(Right)*						
Check traffic (5)	0	0	2	10	2	10
Fails to signal (3)	33	279	28	168	25	210
Proper lane (5)	17	110	29	225	12	65
Speed (3)	1	3	11	39	4	15
Safe gap selection/yield (10)	2	20	0	0	4	50
Fails to make complete stop, obvious roll but safe (5)	2	15	0	0	1	5
Fails to make complete stop, obvious roll and risky (10)	0	0	0	0	1	10
Fails to make complete stop/ Very near stop but vehicle does not settle back (3)	17	63	22	93	17	75
Runs red light (100)	0	0	0	0	1	100
Intersections/turns *(Left)*						
Check traffic (5)	2	15	4	20	1	5
Fails to signal (3)	25	159	22	115	23	96
Proper Lane (5)	9	50	32	300	28	210
Speed (3)	0	0	5	24	0	0
Safe gap selection/yield (10)	3	30	3	30	3	30
Fails to make complete stop, obvious roll but safe (5)	2	10	0	0	1	5
Fails to make complete stop, obvious roll and risky (10)	0	0	0	0	0	0
Fails to make complete stop/ Very near stop but vehicle does not settle back (3)	11	51	10	45	15	51
Runs red light (100)	2	200	1	100	1	100

Tactical Skills	**Pre-Intervention (Drive 1)**		**Immediate Post-Intervention (Drive 2)**		**3-Month Post-Intervention (Drive 3)**	
	Number of Participants With Errors	***Total Error Sum***	**Number of Participants With Errors**	***Total Error Sum***	**Number of Participants With Errors**	***Total Error Sum***
Lane changes:						
Fails to signal (5)	15	120	23	230	18	140
Fails to use mirrors to check traffic (5)	1	5	2	10	5	25
Fails to perform necessary blind spot checks (5)	10	65	14	100	14	85
Position (3)	1	3	4	12	10	30
Speed (3)	1	3	3	9	0	0
Lane (5)	0	0	0	0	0	0
Safe gap selection/yield (10)	0	0	3	30	0	0
Merges on/off limited access hwy						
Judgment of space (5)	3	15	2	25	3	15
Signaling (5)	11	80	8	45	14	75
Speed regulation (5)	7	40	12	75	6	30
Visual scanning/Blind spot (5)	2	15	5	25	3	15
Vehicle handling:						
Judge and regulate speed (5)	8	50	6	40	3	15
Smooth steering (5)	0	0	0	0	1	5
Smooth accelerator (5)	0	0	0	0	0	0
Smooth braking(5)	1	5	0	0	0	0
Appropriate use of signals (5)	11	60	6	30	1	5
Response to traffic signal (5)	3	15	6	40	7	40
Fails to make complete stop, obvious roll but safe (5)	9	45	12	80	5	35
Fails to make complete stop, obvious roll and risky (10)	0	0	0	0	0	0
Parking: Approach (3)	0	0	0	0	0	0
Position (3)	18	63	10	33	11	33
Speed (3)	0	0	2	6	0	0
Backing: Check traffic (5)	3	15	2	10	0	0
Position (3)	0	0	1	3	4	12
Speed (3)	0	0	0	0	0	0
Safe/yield (10)	0	0	0	0	0	0
Traffic circle (5)	0	0	0	0	7	35
Tactical Points Off	**46**	**2,214**	**46**	**2,322**	**46**	**1942**

Strategic Skills	**Pre-Intervention(Drive 1)**		**Immediate Post-Intervention(Drive 2)**		**3-Month Post-Intervention(Drive 3)**	
	Number of Participants With Errors	***Total Error Sum***	**Number of Participants With Errors**	***Total Error Sum***	**Number of Participants With Errors**	***Total Error Sum***
Correct and safe decisions						
Residential (5)	0	0	0	0	0	0
City (5)	0	0	1	15	0	0
Limited access hwy (5)	0	0	0	0	0	0
Route planning(5)	0	0	0	0	0	0
Route logically sequenced (5)	0	0	0	0	0	0
Remembers and executes the route in the preplanned order (5)	1	5	0	0	0	0
Maintains/regulates conversation appropriately (5)	2	10	0	0	0	0
Problems following rules of the road (5)	11	65	7	35	2	10
Fails to make decisions in advance of maneuvers (5)	4	20	3	15	2	10
Separates hazards (5)	0	0	0	0	0	0
Fails to observe cues from other road users (5)	0	0	1	5	0	0
Fails to anticipate(5)	2	10	4	25	0	0
Decreased processing speed(5)	7	45	4	20	1	5
Impaired following directions (5)	6	50	9	60	7	45
Strategic Points Off	21	205	19	175	12	70
Total Points Off	***46***	***2,442***	***46***	***2,523***	***46***	***2,037***
Shaded rows indicate skills targeted by training						

Appendix F: Control Group Error Summary by Drive

CONTROL GROUP (N=43)	**Pre-Intervention (Drive 1)**		**Immediate Post-Intervention (Drive 2)**		**3-Month Post-Intervention (Drive 3)**	
Operational Skills	**Number of Participants With Errors**	***Total Error Sum***	**Number of Participants With Errors**	***Total Error Sum***	**Number of Participants With Errors**	***Total Error Sum***
Independent access to vehicle (1)	0	0	0	0	0	0
Negotiation of driver door (1)	0	0	0	0	0	0
Seat adjustment (3)	2	6	0	0	0	0
Wheel adjustment (3)	0	0	0	0	0	0
Mirror adjustment (3)	0	0	1	3	0	0
Fastens seat belt (3)	0	0	0	0	2	6
Ignition control (3)	1	3	0	0	0	0
Gear selection appropriate (3)	2	9	1	3	2	6
Brake pedal use (3)	1	3	3	9	1	12
Accelerator pedal use (3)	1	15	0	0	0	0
Steering (5)	0	0	0	0	0	0
Signal ability (5)	0	0	0	0	0	0
Adjusts heating and air/radio if needed(5)	0	0	0	0	0	0
Turn signal/lights/wiper/cruise controls used if necessary (5)	0	0	0	0	0	0
Parking brake used if necessary (5)	0	0	1	5	0	0
Operational Points off	***5***	***36***	***6***	***20***	***4***	***24***

Tactical Skills	**Pre-Intervention (Drive 1)**		**Immediate Post-Intervention (Drive 2)**		**3-Month Post-Intervention (Drive 3)**	
	Number of Participants With Errors	***Total Error Sum***	**Number of Participants With Errors**	***Total Error Sum***	**Number of Participants With Errors**	***Total Error Sum***
Visual Skills:						
Fails to scan environment/tunnel vision (10)	1	10	1	10	2	20
Awareness of signage (5)	18	145	10	85	12	65
Attention deficit – "looked but didn't see" (10)	2	20	0	0	0	0
Fails to check speedometer(5)	12	90	5	35	6	40
Runs red going straight	1	100	0	0	0	0
Vehicle Position:						
Lane maintenance/centered position (5)	18	195	14	100	9	55
Drives in proper lane (5)	1	5	2	10	0	0
Follow distance/Lateral Cushion (5)	0	0	0	0	0	0
Stopping position (5)	1	20	0	0	1	5
Response to other traffic (5)	1	5	5	30	3	20
Intersections/turns *(Right)*						
Check traffic (5)	2	10	0	0	2	10
Fails to signal (3)	31	273	28	198	27	228
Proper Lane (5)	10	50	24	250	16	105
Speed (3)	0	0	4	15	2	6
Safe gap selection/yield (10)	1	10	1	10	1	10
Fails to make complete stop, obvious roll but safe (5)	4	20	0	0	1	10
Fails to make complete stop, obvious roll and risky (10)	0	0	1	3	0	0
Fails to make complete stop/ Very near stop but vehicle does not settle back (3)	20	99	24	108	25	117
Runs red light (100)	0	0	0	0	2	200
Intersections/turns *(Left)*						
Check traffic (5)	2	25	3	15	1	5
Fails to signal (3)	25	144	26	153	21	113
Proper lane (5)	12	70	24	190	24	170
Speed (3)	3	9	5	15	0	0
Safe gap selection/yield (10)	3	30	3	30	0	0
Fails to make complete stop, obvious roll but safe (5)	2	10	1	5	0	0
Fails to make complete stop, obvious roll and risky (10)	0	0	0	0	0	0
Fails to make complete stop/ Very near stop but vehicle does not settle back (3)	15	75	11	45	13	55
Runs red light (100)	3	300	2	200	1	100

Tactical Skills	**Pre-Intervention (Drive 1)**		**Immediate Post-Intervention (Drive 2)**		**3-Month Post-Intervention (Drive 3)**	
	Number of Participants With Errors	***Total Error Sum***	**Number of Participants With Errors**	***Total Error Sum***	**Number of Participants With Errors**	***Total Error Sum***
Lane changes:						
Fails to signal (5)	23	225	32	385	29	345
Fails to use mirrors to check traffic (5)	1	5	1	5	1	5
Fails to perform necessary blind spot checks (5)	14	80	11	75	15	85
Position (3)	0	0	6	18	11	36
Speed (3)	2	6	1	3	0	0
Lane (5)	0	0	0	0	0	0
Safe gap selection/yield (10)	1	10	2	20	0	0
Merges on/off limited access hwy						
Judgment of space (5)	5	25	0	0	1	5
Signaling(5)	11	80	8	55	14	90
Speed regulation (5)	8	50	5	30	5	25
Visual scanning/blind spot (5)	2	10	0	0	1	5
Vehicle Handling:						
Judge and regulate speed (5)	6	40	2	10	1	5
Smooth steering (5)	0	0	0	0	0	0
Smooth accelerator (5)	0	0	0	0	0	0
Smooth braking(5)	0	0	0	0	0	0
Appropriate use of signals (5)	6	35	6	30	4	20
Response to traffic signal (5)	6	30	5	30	7	45
Fails to make complete stop, obvious roll but safe (5)	8	45	14	90	7	50
Fails to make complete stop, obvious roll and risky (10)	0	0	0	0	0	0
Parking : Approach (3)	2	6	0	0	0	0
Position (3)	15	51	3	9	4	15
Speed (3)	0	0	0	0	0	0
Backing: Check traffic (5)	2	10	2	10	0	0
Position (3)	3	15	1	3	0	0
Speed (3)	0	0	0	0	0	0
Safe/yield (10)	0	0	1	10	0	0
Traffic circle (5)	0	0	0	0	2	10
Tactical Points Off	**43**	**2,438**	**42**	**2,290**	**43**	**2,075**

Strategic Skills	**Pre-Intervention (Drive 1)**		**Immediate Post-Intervention (Drive 2)**		**3-Month Post-Intervention (Drive 3)**	
	Number of Participants With Errors	***Total Error Sum***	**Number of Participants With Errors**	***Total Error Sum***	**Number of Participants With Errors**	***Total Error Sum***
Correct and safe decisions						
Residential (5)	0	0	0	0	0	0
City (5)	0	0	0	0	0	0
Limited access hwy (5)	0	0	0	0	0	0
Route planning(5)	2	10	0	0	0	0
Route logically sequenced (5)	0	0	0	0	0	0
Remembers and executes the route in the preplanned order (5)	1	5	0	0	0	0
Maintains/regulates conversation appropriately (5)	0	0	0	0	0	0
Problems following rules of the road (5)	10	55	7	35	2	10
Fails to make decisions in advance of Maneuvers (5)	1	5	3	15	0	0
Separates hazards (5)	1	5	0	0	0	0
Fails to observe cues from other road users (5)	2	15	0	0	0	0
Fails to anticipate(5)	2	10	2	10	0	0
Decreased processing speed(5)	4	20	5	35	2	15
Impaired following directions (5)	4	20	8	40	3	15
Strategic Points Off	21	145	19	135	7	40
Total Points Off	***43***	***2,619***	***43***	***2.445***	***43***	***2,139***
Shaded rows indicate skills targeted by training						

Appendix G: Scanning Behavior by Group at Immediate and 3-Months Post-Intervention

Table G-1. Scanning Behavior by Group and Frequency of Glances by Location at Immediate Post Intervention

Glance Direction Drive 2	Glance Frequency (Frequency per Minute)							
	Treatment Group (n=45)				Control Group (n=42)			
	Average	Median	Range	SD	Average	Median	Range	SD
Back (Direct Look)	0.18	0.13	0.0-0.63	0.17	0.11	0.09	0.0-0.34	0.09
Down (Dashboard)	0.73	0.66	0.19-1.93	0.40	0.66	0.53	0.08-2.07	0.40
Left (Mirror/Window)	5.25	5.14	2.94-9.65	1.41	5.15	5.02	2.92-11.87	1.59
Inside Rearview Mirror	1.22	1.07	0.13-3.64	0.73	1.01	0.95	0.13-3.24	0.63
Right (Mirror/Window)	3.82	3.75	1.64-7.16	1.16	3.67	3.05	1.46-11.0	1.87
Total Not Forward	11.21	10.96	5.64-18.21	2.78	10.58	9.88	5.85-25.02	3.52

Table G-2. Scanning Behavior by Group and Duration of Glances by Location at Immediate Post-Intervention

Glance Direction Drive 2	Glance Duration (Percentage of Drive)							
	Treatment Group (n=45)				Control Group (n=42)			
	Average	Median	Range	SD	Average	Median	Range	SD
Back (Direct Look)	0.52	0.41	0.0-2.02	0.55	0.36	0.24	0.0-1.57	0.39
Down (Dashboard)	2.14	1.91	0.48-4.01	1.0	2.16	2.07	0.50-4.54	1.03
Left (Mirror/Window)	13.60	13.24	6.66-30.88	4.13	13.15	13.04	8.35-18.20	2.32
Inside Rearview Mirror	1.69	1.44	0.17-4.83	1.04	1.28	1.27	0.23-3.51	0.64
Right (Mirror/Window)	7.17	7.05	2.86-11.90	1.97	7.29	6.99	3.11-13.57	2.58
Total Not Forward	25.12	24.50	15.09-45.54	6.0	24.22	23.95	15.59-34.63	4.44

Table G-3. Scanning Behavior by Group and Frequency of Glances by Location at 3-Months Post-Intervention

Glance Direction Drive 3	Glance Frequency (Frequency per Minute)							
	Treatment Group (n=45)				Control Group (n=42)			
	Average	Median	Range	SD	Average	Median	Range	SD
Back (Direct Look)	0.20	0.18	0.02-0.50	0.12	0.17	0.17	0.00-0.51	0.11
Down (Dashboard)	0.95	0.87	0.21-2.03	0.45	0.86	0.77	0.31-2.39	0.45
Left (Mirror/Window)	5.11	5.00	2.92-10.29	1.55	4.87	4.84	2.54-8.06	1.26
Inside Rearview Mirror	0.75	0.71	0.11-1.98	0.39	0.59	0.53	0.19-1.55	0.29
Right (Mirror/Window)	4.80	4.65	2.39-7.95	1.36	4.66	4.41	2.10-8.60	1.49
Total Not Forward	11.80	11.53	7.01-18.87	2.67	11.15	10.84	5.95-16.35	2.58

Table G-4. Scanning Behavior by Group and Duration of Glances by Location at 3-Months Post-Intervention

Glance Direction Drive 3	Glance Duration (Percentage of Drive)							
	Treatment Group (n=45)				Control Group (n=42)			
	Average	Median	Range	SD	Average	Median	Range	SD
Back (Direct Look)	0.50	0.45	0.02-1.30	0.30	0.45	0.38	0.00-1.74	0.37
Down (Dashboard)	2.40	2.0	0.37-6.68	1.23	2.26	2.05	0.51-5.92	1.14
Left (Mirror/Window)	12.37	11.52	7.55-24.04	2.90	12.01	11.83	6.90-16.02	1.79
Inside Rearview Mirror	1.06	0.99	0.18-3.25	0.59	0.84	0.73	0.19-1.84	0.41
Right (Mirror/Window)	11.0	10.83	6.03-18.67	2.37	11.60	10.69	6.84-47.95	6.13
Total Not Forward	27.33	27.23	19.83-42.40	4.57	27.15	26.11	20.77-63.25	6.43

DOT HS 813 295
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U.S. Department
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**National Highway
Traffic Safety
Administration**

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