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| Akinwuntan et al. (2005)    | To determine immediate and long-term effects of a simulator training program on on-road performance and overall driving fitness | I RCT  
N = 83 (intervention group, n = 42; control group, n = 41; 81% men; M age = 54) | Intervention  
5-wk, 15-hr training program divided into 1-hr sessions 3×/wk  
Simulator-based training on STISIM Drive system, followed by practice drives with feedback  
Reassessment drive same length but different scenario  
Controls: standardized program of cognitive tasks  
Outcome Measures  
- Acuity and kinetic vision tests  
- UFOV  
- Stroke Driver Screening Assessment  
- On-road tests | After training, experimental group showed greater but not significant improvement.  
Drivers significantly improved on simulator tasks posttraining.  
Improvements in several items during on-road assessment predicted by improvement in select items on simulator.  
Significant difference between groups at 6 mo in passing of on-road assessment.  
Follow-up overall on-road performance predicted by simulator improvements in total number of crashes, excessive speed, and pedestrians hit. | High attrition rate in both groups  
Intention-to-treat analysis using posttraining scores of dropouts showed significant differences favoring experimental group.  
Side of lesion, academic qualifications, and Barthel Index scores predicted improvement in training program.  
Groups differed significantly in educational levels, but effects of attrition on educational levels not reported.  
Long-term follow-up did not include measures of physical or functional recovery. |
| Bédard et al. (2008)        | To determine whether an in-class educational program combined with on-road education changes safe driving knowledge and on-road performance | I Multisite RCT  
N = 75 (intervention group, n = 38; wait-list control group, n = 37; 54% women; M age = 75)  
Evaluator consistent per site; blinded to group assignment | Intervention  
AARP 55-AliveMature Driving Program (2 sessions, 3–4 hr), two 30- to 40-min on-road standardized practice sessions with certified instructor providing feedback on driving  
Outcome Measures  
- Test on safe driving knowledge  
- Standardized on-road evaluation | Statistically significant improved knowledge after in-class educational program  
Significant difference in intervention group's on-road evaluations  
Posteducation drivers received fewer demerit points for unsafe driving actions in some areas of road test.  
Control group showed some but not significant improvements in driving performance. | Possible variations in on-road performance resulting from use of driver's own car and program's dual-brake car  
Inconsistent outcome data collection per site  
Unknown whether 1 intervention or combination of interventions resulted in changes  
No long-term follow-up |
| Caragata, Tuokko, & Damini (2009) | To determine whether a community-based physical fitness exercise program could improve self-reported driving skills and behaviors | II Nonrandomized convenience sample with 2 groups and evaluator blinded to group assignment  
N = 24 (19 participants, 5 controls; 61% men; study group M age = 76.3; control group M age = 74) | Intervention  
1-hr fitness class 2×/wk for 6 wk in community setting  
Several exercises mimicked driving behaviors and used driving-related props.  
Visual tracking exercises included | Men in study group improved on 1 physical item; women improved significantly on 50% of items.  
Study group significantly improved on 50% of measures compared with control group, which improved on 3 of 18 measures. | Small sample size with inadequate power  
Convenience sample may have biased enrollment.  
Limited time for improved physical fitness |

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<td>Cassavaugh &amp; Kramer (2009)</td>
<td>To determine whether training on computer-based cognitive tasks transfers to simulated driving performance</td>
<td>III Pretest–posttest</td>
<td>Participants engaged in 2 driving sessions on DriveSafety simulator; 8 computer-based cognitive training sessions; and 2 final driving sessions. All 90-min sessions took place on separate days.</td>
<td>Half of study group reported improved health; 73.7%, improved physical fitness; 55.6%, improved driving skills; and 38.9%, increased confidence driving; last 2 results primarily reported by women (90% and 86%, respectively).</td>
<td>Majority of changes reported in significantly younger women, limiting generalizability of results</td>
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<td>Crotty &amp; George (2009)</td>
<td>To determine the effectiveness of a training program using Dynavision on driving performance in people with stroke</td>
<td>I RCT</td>
<td>18 sessions on Dynavision 2000 Light Training Board 40-min sessions 3×/wk for 6 wk graded in complexity depending on skill level</td>
<td>No significant differences found between groups on on-road assessment or Visual Scanning Analyzer, Abilities in Response Time Measures, or ADSES scores.</td>
<td>Small sample and no control group Participants relatively young; questionable whether similar results would be seen in &gt;80 age group</td>
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Notes: Includes randomized controlled trials (RCT), observational studies, and single case reports. Outcome Measures include various physical and mental tests, as well as self-reported questionnaires. Results typically report on improvements in health, driving skills, confidence, and self-perceived changes in ease of driving. Study Limitations may include small sample sizes, limited generalizability, and potential for Type I errors due to multiple statistical tests.
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| Edwards, Myers, et al. (2009) | To determine whether cognitive speed-of-processing training delays or slows decline in driving mobility in at-risk older drivers | I RCT  
N = 500 (age 60 or older)  
n = 124 with poor UFOV test scores randomized to speed-of-processing training (n = 61) or social and computer contact control group (n = 63)  
Reference group, n = 366 | Intervention  
10 1-hr computer-based cognitive speed-of-processing sessions 2x/wk for 5 wk  
Level of difficulty changed by trainer on the basis of performance  
Control group received equal number of sessions with similar social contact and general instruction on computer hardware, email accounts, and accessing the Internet.  
Outcome Measures  
• Mobility Questionnaire  
• Self-reported health conditions  
Outcomes gathered at baseline and 3 yr | No group difference in age, balance, cognition, vision or driving space, exposure, or difficulty at baseline  
Cognitive speed-of-processing training appeared to delay mobility declines in older drivers with poor UFOV scores.  
No group difference at 3 yr in driving exposure, space, and most aspects of driving difficulty  
Drivers with poor UFOV scores at risk for declines in driving mobility randomized to control group experienced greater mobility declines and difficulties compared with reference group. | Only self-report of driving difficulties was collected.  
No objective measures of driving habits were collected.  
Multiple data collection points with longer overall study period would be helpful to identify trajectories.  
Some declines in driving mobility may be due to physical and general functional declines, but studies collected only balance and vision data. |
| Gaines, Burke, Marx, Wagner, & Parrish (2011) | To determine the short-term effects of the CarFit program, including participants’ follow-through with recommendations | I RCT  
N = 195 drivers recruited from independent living residences of a continuing care retirement community who consented to participate in a CarFit event (92% White; 54% female; M age = 78.8)  
n = 83 randomized to CarFit  
n = 112 randomized to comparison group | Intervention  
Participation in a CarFit event and completion of a driving survey before randomization to CarFit event and 6 mo later  
Driving questionnaire yielded 3 subscale scores: driving activities indicating possible self-regulation, driving behaviors (e.g., frequency of 26 driving behaviors), and comfort level during driving activities.  
Outcome Measures  
• Driving behavior survey  
• Follow-through with CarFit recommendations  
Outcomes gathered at baseline and 3 yr | More than half of both CarFit group and comparison group engaged in ≥1 self-regulatory behaviors at baseline.  
2.9 recommendations were made to CarFit participants (range = 0–7) with 13.8% receiving no recommendations.  
60.8% of CarFit participants reported implementing ≥1 recommendations.  
CarFit participants reported a decreased level of comfort in their driving at the 6-mo period vs. baseline. | Recruitment of participants from a continuing care retirement community with alternative transportation options may have affected patterns of self-regulatory behaviors.  
Self-report of implementation of recommendations may have been influenced by recall bias and social desirability. |
| Horswill, Kemala, Wetton, Scialfa, & Pachana (2010) | To determine whether video-based hazard perception training could improve latency of hazard perception ability in older drivers | I RCT  
N = 24 (58% women; M age = 75.33) | Intervention  
17-min video of real driving displaying hazardous situations  
Expert driver narrated where attention was focused and provided advice about anticipating hazards. | No significant difference found on demographic, visual, cognitive, depression, or simple reaction time tests between groups.  
Intervention group significantly reduced hazard latencies between pretest and posttests. | Unknown whether improvements observed (average of 513 ms) result in lasting or meaningful change to real-world driving safety.  
Short time between pretest, training, and posttest (all within 2 hr) |
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<td>Korner-Bitensky, Kua, von Zweck, &amp; Van Benthem (2009)</td>
<td>To determine the effect of older driver training on driving-related skills and crash rates</td>
<td>I Systematic review of Level I-II studies</td>
<td>Participants were instructed to consider what can and cannot be seen and what might happen. Control: Same video scenarios without commentary; instructed to pay attention as if they were driver of vehicle Both groups took hazard perception test before and after viewing video. 14- and 16-min test versions were counterbalanced.</td>
<td>Control group showed no significant change. No significant difference between groups at pretest but significant difference favoring intervention group at posttest Simple reaction time tests did not show difference.</td>
<td>Lack of simulated or real-world driving performance or crash data Differences in instructions to groups may have contributed to difference in performance, making it difficult to determine what contribution expert driver commentary had on performance.</td>
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<td>Kua, Korner-Bitensky, Desrosiers, Man-Son-Hing, &amp; Marshall (2007)</td>
<td>To determine the effectiveness of older driver retraining</td>
<td>I Systematic review of Level I-III studies</td>
<td>Method consisted of systematically selecting and analyzing Level I-III studies using predefined criteria. Outcome Measures: On-road driving performance, Crashes (fatal and nonfatal), Insurance claims, Driving knowledge</td>
<td>Strong evidence that educational interventions improve driving awareness and driving behaviors Moderate evidence that educational interventions do not reduce crashes and no evidence that educational interventions combined with on-road training reduce crashes Strong evidence that educational intervention combined with on-road training improves driving knowledge and on-road driving performance Moderate evidence that physical retraining improves driving knowledge and on-road performance but no evidence that physical training reduces crash risk</td>
<td>Inconsistent collection of data at all sites Heterogeneity in study populations, control groups, and types of educational programs requires cautious interpretation of results. Questionable blinding of examiners, statistical analyses that may have confounded results, and small subgroup sizes Heterogeneity in study populations and types of educational programs</td>
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<td>Marottoli, Allore, et al. (2007)</td>
<td>To determine whether at-risk older drivers who participated in a physical conditioning intervention demonstrated improved on-road driving performance</td>
<td>I RCT using pretest–posttest control group (stratified by recruitment site using a permuted block scheme then randomized)</td>
<td>Outcome Measures: • Increased trunk rotation, shoulder flexibility, vehicle handling, and observing procedures • On-road driving performance • Flexibility • Crashes (fatal and nonfatal) and traffic citations • Self-awareness and driving knowledge • Self-perception of vision quality • Safe driving strategies</td>
<td>Intervention group maintained driving performance, and control group's declined. Intervention group with lowest baseline performance showed an increase in driving performance over 3-mo period. Intervention group made 27.1% fewer critical errors than control group during on-road assessment.</td>
<td>Possible selection bias—permuted block randomization method used over 2-yr trial. On-road assessment has potential for some participants to encounter more or different events, requiring more decision making or evasive reactions. Low enrollment of women and minorities limits ability to generalize findings. No log of completion of daily exercise program or other physical fitness activities (e.g., walking). Interaction of these separate programs may have enhanced driving performance.</td>
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<tr>
<td>Marottoli, Ness, et al. (2007)</td>
<td>To determine whether a classroom educational program combined with on-road training would improve driving performance in older adults</td>
<td>I RCT using a permuted block scheme: N = 126 (15% women; M age = 80)</td>
<td>Intervention: AAA Driver Improvement Program; 2-hr on-road driving addressing common problem areas over 8-wk period</td>
<td>Intervention group showed significant increase in knowledge test scores (3.45 points) and road test scores (2.87 points and 36% fewer critical errors) compared with control group. Improvement observed predicted to equal 9.5% reduction in crash risk.</td>
<td>Enrollment occurred over several years; conditions of roads for on-road assessment might have changed (e.g., undergone improvements or deterioration). 84% recruited from regional Veterans Affairs hospital; 15% women, which limits generalizability. Overlap between classroom and on-road training; unable to</td>
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## Supplemental Table 1. Selected Evidence for Person-Related Interventions (cont.)

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| Nasvadi & Vavrik (2007) | To determine whether older drivers who attend a mature driving program have a self-selection bias, have reduced crash rate after attendance, and adopt coping strategies addressed in program | II–IV based on phase Retrospective cohort design using matched control group (Level II), pretest–posttest design using matched-pairs cohort design (Level III); focus group (Level IV) | Intervention AARP 55-Alive/Mature Driving Program  
Outcome Measures  
Per phase:  
• Crash rates and violations for 2-yr period before program  
• Crash rates for 2-yr period after program  
• Changes to driving habits resulting from course | Phase 1: Self-selection bias in older adult drivers who attend a mature driving course; attendees had significantly more crashes and police-attended crashes; no significant difference in number of violations.  
Phase 2: Odds ratio of attendees being involved in crash higher but not significantly higher. Male drivers age 75 or older were significantly more likely to be involved in crash.  
Phase 3: Male attendees made fewer modifications to driving to adapt to declining skills. | Only 1 geographic region studied  
Different instructors may have emphasized different information in curriculum.  
Mean ages of genders differed in Phase 1 of the study.  
Focus group only a small portion of overall group and may not reflect larger group |
| Romoser & Fisher (2009) | To determine whether feedback on simulated driving performance would change older drivers’ perceptions of their skills and receptiveness to changing their driving behavior and whether feedback combined with active practice would improve driving skill at intersections | II Nonrandomized trial  
Experiment 1: N = 36 (n = 18 M age = 77.7; n = 18 M age = 35)  
Experiment 2: N = 54 equally divided into 3 age groups (70–74, 75–79, and 80–89) and 3 conditions (active learning, passive learning, control; balanced for gender; M age = 77.54) | Intervention  
Experiment 1: Series of 10 simulator scenarios; driver wore head-mounted eye tracker and magnetic head tracker.  
8 scenarios involved intersections.  
Feedback on video-taped drives supported positive driving behaviors or pointed out errors and possible consequences.  
Participants were shown video of experimenter driving same scenario either involving a crash or demonstrating how older driver should have performed.  
Experiment 2: Active learning group: personalized feedback on video replay of 20-min simulator drive (all ages) and 30-min drive in community (ages 70–79 only)  
Experiment 2: Active training group significantly increased secondary looks 35% from pretraining to posttraining in simulator; no significant difference between passive learning and control groups.  
Active training group significantly improved (37.9%) secondary looks in community drives; passive training and control groups showed no change. | Experiment 1: Older drivers were almost 3x as likely to require review and feedback on performance; made significantly more errors across all scenarios; were 3x as likely to fail to take secondary look and 10x as likely to turn too slowly; and significantly more receptive to changing driving behaviors after receiving feedback.  
Experiment 2: Drivers 80 and older were prohibited from participating in on-road test.  
34 (38.4%) drivers initially recruited dropped out after practice drive because of simulator sickness.  
No predictive measures of dropout; physical measures included only Get Up and Go Test as measure of vestibular function, which may not have captured people with vestibular disorders who limit head rotation (required for secondary looks) while driving to prevent motion sickness. | Device worn to track head and eye movements may have served as a tactile reminder to scan environment or limit naturally occurring movement.  
Experiment 2: Drivers 80 and older were prohibited from participating in on-road test.  
34 (38.4%) drivers initially recruited dropped out after practice drive because of simulator sickness.  
No predictive measures of dropout; physical measures included only Get Up and Go Test as measure of vestibular function, which may not have captured people with vestibular disorders who limit head rotation (required for secondary looks) while driving to prevent motion sickness. |
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<td>Söderström, Pettersson, &amp; Leppert (2006)</td>
<td>To determine whether drivers with stroke who failed a driving test could improve their driving ability with on-road training</td>
<td>II 2 groups nonrandomized $N = 54$ Intervention group, $n = 34$ with 1st cerebral insult (time since insult, 1.4–14 mo; 94% men; $M$ age = 54; range = 28–67) Control group, $n = 20$ matched for age, gender, education, and driving experience</td>
<td>Intervention Drivers who failed on-road evaluation were provided with 2-hr lesson on traffic theory and on-road training. Number and type of on-road training graded by errors made in on-road test; either 6 hr or 12 hr training on the basis of scores. Controls completed same assessments but were not offered training if they failed on-road evaluation. Outcome Measures • Neuropsychological test battery • Traffic Theory Knowledge Test (TTKT)</td>
<td>Though not significant, larger percentage of control group failed road driving preassessment. 44% of stroke group failed road test and were offered either 6 hr of training (8 drivers) or 12 hr of training (7 drivers). 87% passed follow-up road test after training; no significant changes noted in neuropsychological tests. Participants who completed on-road training showed significant increase in scores on TTKT.</td>
<td>Small sample size; time since stroke, severity of impairments, and locations and types of stroke heterogeneous Number of participants age 65 or older not stated; oldest participant was 67 On-road assessments and training sessions varied in traffic, road, risk, and weather conditions. Dichotomous pass–fail score on on-road test may not capture change.</td>
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<td><strong>Stanton, Walker, Young, Kazi, &amp; Salmon (2007)</strong></td>
<td>To determine effects of a driver coaching program on driver knowledge, skills, and attitude</td>
<td>II Nonrandomized, pretest–posttest design using matched sample for age, experience, and annual mileage</td>
<td>Intervention Driving coaching program and distributed practice (6 observed drives lasting 45 min each over 8–12 wk) Feedback provided by coach focused on method to approach and negotiate hazards to reduce crash risk.</td>
<td>No significant difference between groups at baseline in knowledge (situational awareness [SA]); significant differences observed in quantity, type, structure, and interconnectivity of SA in intervention group after training. Coached drivers showed significantly improved behaviors and skills. Control groups showed significant decreases in quality of driving. No significant change in internal locus of control from baseline in intervention group but statistically significant reduction in externality scores postintervention.</td>
<td>Recruitment differed (control groups paid; intervention group self-selected volunteers); difference may have led to significant group differences in internality scores at baseline. Intervention group saw driving behaviors within their control and self-enrolled to improve driving. Study design did not enable blinding of observer or coaches to participants' group assignment. Implications for older drivers as a group are uncertain because percentage of older drivers in study was not provided.</td>
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<td><strong>Stav (2010)</strong></td>
<td>To determine the usefulness of the CarFit program on safety behavior changes and likelihood of participants to recommend CarFit to others</td>
<td>IV Descriptive study with analysis of outcome</td>
<td>Intervention Standardized CarFit program 12-point checklist and postevent survey</td>
<td>70% reported making ≥1 adjustment to vehicle: side mirrors (90.3% for left and 100% for right), head restraint (92.8%), and steering wheel tilt (88.8%). 74% discussed CarFit program with others.</td>
<td>Sample size relatively small and restricted to small regional area No information on reliability and validity of survey</td>
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<td><strong>Stern et al. (2008)</strong></td>
<td>To determine efficacy of a group-based psychoeducational intervention for caregivers of older drivers with dementia to assist in driving cessation</td>
<td>I RCT</td>
<td>Intervention ACT: Four 2-hr 4-wk educational support groups of 4–10 caregivers using At the Crossroads: Family Conversations About Alzheimer’s Disease, Dementia and Driving (Hartford Financial Services Group, 2000) booklet; standardized curriculum led by same facilitator WRT: At the Crossroads booklet, information for local Alzheimer’s Association, and list of local driving evaluation programs</td>
<td>Participants in ACT group scored significantly higher on self-efficacy, stage of change-preparation scale. Venting subscale of Brief COPE, communication with loved one about driving, and awareness and use of agreement form. WRT and CTL groups did not significantly differ from each other on these scales. ACT and WRT groups scored significantly higher on Acceptance small sample size; control group smaller than other 2 groups Smaller control group was younger, consisted of fewer women and more adult children than other 2 groups. No objective measures of drivers; only caregiver report of level of impairment Large variety of cognitive function in drivers with dementia</td>
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<td>Strong, Jutai, Russell-Minda, &amp; Evans (2008)</td>
<td>To determine effectiveness of driver rehabilitation interventions for people with low vision</td>
<td>I Systematic review of Level I and II studies $N = 7$ studies, all RCTs Interventions included education programs and assistive technologies such as Fresnel prisms or Gottlieb Visual Field Awareness System</td>
<td><strong>CTL:</strong> Written materials provided after posttest  <strong>Outcome Measures</strong> - 7-item self-efficacy questionnaire - Brief COPE Inventory - 2-item scale on preparation stage of Transtheoretical Model of Change - Additional questions regarding relationship, communication, and agreement to stop driving</td>
<td>subscale of Brief COPE but did not differ significantly from each other. No long-term follow-up to determine whether driving cessation occurred in safe and timely fashion</td>
<td>Educational programs used by various studies differed, and instructors' level of expertise in both classroom and on-road training varied. Possible learning effect: UFOV used for both assessment and training</td>
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**Note.** $M =$ mean; RCT = randomized controlled trial; UFOV = Useful Field of View.

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