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<td>Akinwuntan et al. (2005)</td>
<td>To determine the immediate and long-term effects of a simulator intervention program on on-road performance and overall driving fitness</td>
<td>I RCT</td>
<td>Intervention: 5-wk, 15-hr program divided into 1-hr sessions 3×wk of simulator-based intervention on the STISIM Drive® system in a full-size car with adaptive aids as needed. Pre-intervention assessment scenario varied in traffic, highway, and speed conditions. Practice drives were followed by feedback. Re-assessment drive was same length but used a different scenario. Control group completed a standardized program of cognitive tasks using maps, numerical memory interventions, tile patterning, and road and traffic sign recognition.</td>
<td>Intervention on-road assessment. At postintervention, the intervention group showed greater (but not significant) improvement. Drivers improved significantly on simulator tasks postintervention. Improvements in several items during on-road assessment were predicted by improvement in selected items on the simulator. A significant difference was found between groups at 6 mo in passing of on-road assessment. At follow-up, improved driving performance in the simulator (i.e., decreases in total number of crashes, excessive speed, and pedestrians hits) predicted overall road performance. A combination of more education and reduced disability predicted improved on-road performance in the intervention group.</td>
<td>Possible selection bias is indicated by the attrition rate of 28.8% in both groups. No variable appeared to predict dropout, but limited demographics were provided. Intent-to-treat analysis using postintervention scores of dropouts showed significant differences favoring the experimental group. Groups differed significantly in educational levels, but effects of attrition on education were not reported. Long-term follow-up did not include measures of physical or functional recovery.</td>
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<td>Crotty &amp; George (2009)</td>
<td>To determine the effectiveness of an intervention program using Dynavision in improving driving performance in people with stroke</td>
<td>I RCT</td>
<td>Intervention: 18 sessions on Dynavision Light Training Board 2000, 40-min sessions 3×wk for 6 wk, graded in complexity depending on skill level. Control participants were assigned to wait list.</td>
<td>No significant differences were found between groups on the on-road assessment (p = .223).</td>
<td>Study group varied in time since stroke (1 mo to &gt;2 yr). No exclusion criteria were used for age or driving frequency. No standardized screening was used for visual neglect, visual attention, or motor severity. Significant differences were found between groups at initial assessment on sections of Visual Scanning Analyzer and Abilities in Response Time Measures. Standardized on-road assessments may have varied in weather, traffic, and risk conditions for each driver. Type 1 errors were possible because of the number of statistical tests performed.</td>
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### Supplemental Table 1. Evidence for the Effect of Rehabilitation Interventions on the Driving Performance of Medically At-Risk Older Drivers (cont.)

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<td>Devos et al. (2009)</td>
<td>To determine whether a comprehensive driving intervention program using a simulator had better carryover to driving skills than a cognitive intervention program</td>
<td>I Further analysis of data from RCT by Akinwuntan et al. (2005) N = 73 subacute stroke patients 6–9 wk post first stroke (intervention group: n = 37, mean age = 54, SD = 12, days since stroke = 53, SD ± 6; control group: n = 36, mean age = 54, SD ± 11, days since stroke = 54, SD ± 6)</td>
<td>Intervention Simulator intervention. Control group received a cognitive intervention. Outcome On-road driving performance using TRIP immediately after intervention and 6 mo poststroke</td>
<td>Overall on-road performance improved significantly over time in both groups; patterns of improvement differed. The intervention group showed greater improvement postintervention and at follow-up in overall score and subcomponent scores of anticipation and perception of signs, visual behavior and communication, quality of traffic participation, and left turns.</td>
<td>Simulator intervention gradually increased in complexity, whereas the cognitive games did not. A ceiling effect to TRIP may have missed improvements in approximately 25% of the intervention group postintervention. Dropout rate was high (12% postintervention and 37% at 6-mo follow-up). Intention-to-treat analysis showed dropout rate did not change results obtained.</td>
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<td>Devos et al. (2010)</td>
<td>(1) To determine the effect of simulator vs. cognitive rehabilitation therapy on fitness to drive (i.e., performance in on-road and off-road tests) at 5 yr poststroke and (2) to investigate differences in clinical characteristics between stroke survivors who resumed and stopped driving</td>
<td>I 5-yr follow-up of RCT by Akinwuntan et al. (2005) N = 61 subacute stroke patients (78.7% men; intervention group: n = 30, mean age = 58, SD ± 12; control group: n = 31, mean age = 59, SD ± 12)</td>
<td>Intervention 5-wk, 15-hr program divided into 1-hr sessions 3×/wk of simulator-based intervention on the STISIM Drive® system in a full-size car with adaptive aids as needed. Preintervention assessment scenario varied in traffic, highway, and speed conditions. Practice drives were followed by feedback. Reassessment drive was same length but used a different scenario. Control group completed a standardized program of cognitive tasks using maps, numerical memory interventions, tile patternin, and road and traffic sign recognition.</td>
<td>At 5 yr poststroke, 34 of 61 (55%) participants were driving; 18 of 30 participants (60%) in the intervention group were considered fit to drive compared with 15 of 31 (48%) in the control group (p = .36). Current drivers were younger (p = .04), had higher Barthel Index scores (p = .008), had less comorbidity (p = .01), and were less severely depressed (p = .02) compared with those who gave up driving.</td>
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<td>Mazer et al. (2003)</td>
<td>To compare the effectiveness of a visual attention intervention program using the UFOV with a traditional visuoperception treatment program in promoting the driving performance of clients with stroke</td>
<td>I RCT N = 97 stroke patients (intervention group: n = 47, mean age = 65.5, SD ± 11.4, 74.5% male, days poststroke = 91.2, SD ± 51.8; control group: n = 50, mean age = 66.5, SD ± 8.9, 70.0% male, days poststroke = 66.7, SD ± 28.2)</td>
<td>Intervention Four 1-hr sessions/wk for 5 wk. Intervention group received 20 sessions of UFOV for visual processing speed and divided and selective attention. Control group received 20 sessions of targeted perceptual and cognitive skills intervention using computerized programs—Tetris, Mastermind, Othello, and Jigs@l Puzzle.</td>
<td>At pretest, the groups did not differ on personal characteristics, medical condition, rehabilitation involvement preintervention (other than the time of evaluation poststroke), driving competence and importance, or frequency and reasons they had driven before their stroke. At posttest, no significant differences were found by group in Rate of noncompliance was 17% in the intervention group and 12% in the control group. More participants withdrew than expected, decreasing to 82% the power of the study to detect a 30-percentage-point difference. The study did not have sufficient power to detect significant differences between the intervention and control groups.</td>
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### Supplemental Table 1. Evidence for the Effect of Rehabilitation Interventions on the Driving Performance of Medically At-Risk Older Drivers (cont.)

| Author/Year                  | Study Objectives                                                                 | Level/Design/Participants                                                                 | Intervention and Outcome Measures                                                                 | Results                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Study Limitations                                                                                                                                                                                                                           |
|-----------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                           |
| Söderström, Pettersson, & Leppert (2006) | To determine whether drivers with stroke who failed a driving test could improve their driving ability with an on-road intervention | II 2 groups, nonrandomized  
N = 54 stroke patients (intervention group: n = 34 with first cerebral insult; time since insult 1.4–14.0 mo, mean age = 54, SD ± 8.8, range = 28–67, 94% men; control group: n = 20 matched for age, gender, education, and driving experience) | Intervention  
Participants who failed the on-road evaluation received 2-hr lessons on traffic theory and on-road intervention. Errors made in the on-road test were used to calculate the number of hours of intervention and type of intervention (traffic theory and on-road intervention); participants received either 6 hr or 12 hr of intervention on the basis of their on-road test scores. Control group completed the same assessments but were not offered an intervention if they failed the on-road evaluation.  
Outcomes  
- Primary: Results of a 1-hr road test on a predetermined route with 5 subvariables graded on a 5-point scale  
- Secondary: TTKT, neuropsychological test battery | Although not significant, a larger percentage of the control group failed road driving preassessment. Of the intervention group, 44% failed the on-road test and were offered either 6 hr of intervention (n = 8) or 12 hr of intervention (n = 7). Of those who failed the initial road test, 87% passed the follow-up road test after intervention. Participants who completed the on-road intervention had significant increases in TTKT scores, f(9) = 3.06, p = .016. | Sample size was small; time since stroke, severity of impairments, and locations and types of stroke were heterogeneous. Number of participants age 65 or older was not stated; oldest participant was 67.  
On-road assessments and intervention sessions varied in traffic, road, risk, and weather conditions. Dichotomous pass–fail score on on-road test may not have captured change. Intervention was not explained sufficiently. No intervention was provided to control participants who failed; therefore, no comparison was possible between experimental and control groups who failed the on-road test. |

| Bowers, Peli, Elgin, McGwin, & Owsley (2005) | To determine, through self-report, the extent to which bioptic telescopes were used by and met the driving needs of people with moderately reduced visual acuity | IV Survey design  
N = 58 low vision users (mean age = 47, SD ± 17, range 17–86; 62% men) | Intervention  
Bioptic telescope when driving. Control group received no intervention.  
Outcomes  
- Mean bioptic helpfulness score  
- Percentage of time viewing with bioptic | 62% of participants reported wearing the telescope all the time when driving; 74% rated the bioptic telescope as very helpful, and 90% would continue to use it for driving. 100% of participants used a telescope for reading road signs, whereas fewer than 30% used a telescope for seeing brake and signal lights or judging the distance to the car in traffic. | Sample was limited in size, a convenience sample, and not a homogeneous group of older drivers. Drivers who did not use or rarely used their bioptic telescopes were probably underrepresented, especially in the group recruited via the advertisement on the Bioptic Drivers website. Study captured (Continued) |
Supplemental Table 1. Evidence for the Effect of Rehabilitation Interventions on the Driving Performance of Medically At-Risk Older Drivers (cont.)

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| Owsley, Stalvey, & Phillips (2003) | To evaluate 6-mo outcomes after an educational program to promote safe driving practices among visually impaired older drivers | Experimental design with participants randomly assigned to 2 groups  
N = 365 high-risk older drivers legally licensed to drive in AL  
(mean age = 74, range = 60–91,  
SD ± 6; 23% African American,  
77% White; 69% men) with visual acuity of 20/30 to 20/60 and/or visual processing deficits of >40% on UFOV | Intervention  
Usual care plus KEYS individual educational intervention: 2 educational sessions that included a 2-hr visit and a booster session 1 mo later. Control group received usual care (eye care specialist discussed impact of any diagnosed visual impairment on activities of daily living such as driving).  
Outcomes  
• Self-perceptions of vision and driving  
• Attitudes toward driver safety  
• Driver behavior: self-regulatory practices, driver dependency | At posttest, compared with the control group, the intervention group reported  
• more difficulty with visually challenging driving situations, \( t(352) = 4.4, p < .01 \)  
• more frequent performance of self-regulatory practices, \( t(350) = 8.24, p < .01 \)  
• more frequent avoidance of hazardous driving, \( t(360) = 6.21, p < .01 \)  
• similar likelihood of increasing their dependence on others to drive, \( t(361) = 1.44, p = .14 \)  
• fewer places traveled to, \( t(361) = 2.01, p < .05 \); fewer trips per wk, \( t(361) = 2.26, p < .02 \); and fewer days driven per week, \( t(361) = 2.01, p < .05 \) | Generalizability of findings to drivers beyond AL is limited. No blinding was used, outcomes were self-reported, and no valid driving outcomes were assessed. |

| Owsley et al. (2004) | To determine whether an individualized educational program promoting strategies to enhance driver safety reduced the crash rate of high-risk older drivers | Randomized, controlled, single-masked intervention evaluation at an ophthalmology clinic | Intervention  
Usual care plus KEYS individual educational intervention promoting safe driving strategies. Control group | The intervention group did not differ significantly from the usual care–only group in crash rate per 100 person-years of driving, relative risk (RR) = 1.08, 95% CI | Generalizability of findings to drivers beyond AL is limited. No blinding was used. |

\( R^2 = \) coefficient of determination, \( p \) = significance level.
### Supplemental Table 1. Evidence for the Effect of Rehabilitation Interventions on the Driving Performance of Medically At-Risk Older Drivers (cont.)

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| Stalvey & Owsley (2003) | To determine the efficacy of an educational intervention for visually impaired older drivers in improving self-awareness and self-regulation of driving | I  Experimental design with participants randomly assigned to 2 groups  
N = 365 high-risk older drivers with visual acuity of 20/30 to 20/60 and/or visual processing deficits of 40% on UFOV and legally licensed to drive in AL (mean age = 74, range = 60–91, SD ± 6; 23% African American, 77% White; 69% men)  
Intervention  
Usual care plus KEYS individual educational intervention: 2 educational sessions that included a 2-hr visit and a booster session 1 mo later. Control group received usual care (eye care specialist discussed impact of any diagnosed visual impairment on activities of daily living such as driving).  
Outcomes  
- Self-perception of vision  
- Perceived threat  
- Perceived barriers  
- Perceived benefits  
- Regulatory self-efficacy | | [0.71–1.64], and per 1 million person-miles of travel, RR = 1.40, 95% CI [0.92–2.12]. The intervention group reported more avoidance of challenging driving maneuvers and self-regulatory behaviors during follow-up than the usual care-only group (p = .0001). | The intervention group improved self-perceptions of vision impairment and understanding of its impact on driving compared with the control group, t(362) = 4.42, p < .01, and perceived a greater number of benefits in the performance of self-regulatory behaviors, t(352) = 3.53, p < .01. Generalizability of findings to drivers beyond AL is limited. No blinding was used, outcomes were self-reported, and no valid driving outcomes were assessed. |
| Szlyk et al. (1998) | To test the effectiveness of an amorphic biopic lens in patients with retinitis pigmentosa (RP), choroideremia, and Usher’s syndrome type 2 | II  Crossover study design  
N = 15 adult and older adult drivers with peripheral field and visual acuity impairment (mean age = 44.2, SD ± 13.4, range = 27–67; 7 women, 8 men) and RP (n = 13), choroideremia (n = 1), or Usher’s syndrome type 2 (n = 1)  
Intervention  
Training in functional use of amorphic lenses over 3 mo. Control group had wait period of 3 mo and then received the intervention.  
Outcomes  
- Mobility outcomes, measured as walking-related activities  
- Driving measures on the simulator: Accidents, braking response time, speed, deceleration ratio  
- Road test: Pulling out into traffic, negotiating traffic  
- Global driving score | Overall, test scores improved; improvement ranged from 46.4% in the mobility category to 27.0% in the scanning category, with an overall improvement of 37.3%. Sample size was small, age groups were heterogeneous, no blinding was used, no detailed results of simulator or on-road components were provided, and generalizability of findings is limited. |
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| Szlyk et al. (2000)    | (1) To evaluate a bioptic telescope training intervention aimed at people with central vision loss to improve life skills, including driving, and (2) to compare the outcomes of people given bioptic telescopes and a training intervention with those of people prescribed telescopic lenses without a training intervention. | II 2-group crossover experimental design with a third, control group not crossing over  
* N = 25 adolescent, adult, and older drivers with central vision loss (age range 16–78; 13 men, 12 women)                                                                                                                                                                                                 | Intervention  
Group 1 received bioptic telescopes and orientation and mobility intervention for 5 wk followed by a driving intervention in a simulator and on the road for 8 wk during the first 3-mo period of the 6-mo study.  
Group 2 received lenses and training during the second 3-mo period of the study. The driving intervention consisted of reading dashboard displays, maintaining proper vehicle position, engaging in gap acceptance, locating traffic control signs, improving visual memory skills, using mirrors, and navigating complex traffic situations as a passenger. Control group received the lenses for approximately 3 mo without any training.  
* Outcomes  
- Recognition  
- Mobility  
- Peripheral identification  
- Scanning  
- Tracking  
- Visual memory | Participants showed significant improvement in all task categories with use of the telescopes. The intervention groups improved; the trained and untrained groups differed significantly only in the recognition, peripheral identification, and scanning categories but not in mobility, tracking, or visual memory. When the tasks involving driving-related skills were analyzed separately, training also resulted in a significant difference between the intervention groups and the control group,  
  \[ t(20) = 2.45, \quad p = .02 \]. | Sample size was small, age groups were heterogeneous, no blinding was used, no detailed results of simulator or on-road components were provided, and generalizability of findings is limited. |
| Szlyk, Seiple, Stelmack, & McMahon (2005) | (1) To compare the outcomes of orientation and mobility (O&M) and driver training interventions with Fresnel prisms and the Gottlieb Visual Field Awareness System for patients with homonymous hemianopsia and (2) to determine whether participants continued to use the prisms at 2-yr follow-up | II Experimental design with random assignment  
* N = 10 adolescent, adult, and older drivers (mean age = 52.3, range = 16–74; all male) with left or right hemianopsia because of cerebral vascular accidents (n = 8), brain tumor (n = 1), or arteriovenous malformation (n = 1). Participants were screened to include only occipital lobe strokes; 7 had left hemifield loss and 3 had right hemifield loss. | Intervention  
Gottlieb prisms and intervention the first 3 mo of the study, then Fresnel prisms and intervention in last 3 mo of the study. The O&M intervention consisted of four 2- to 3-hr sessions in the lab conducted by a low vision specialist. The driving skill intervention consisted of eight 2-hr sessions conducted by a kinesiotherapist and included spotting critical roadway information, using the prisms to read vehicle instrumentation, and executing maneuvers. Control group received the same interventions in reverse order. | Patients with hemianopsia showed improvements in all of the visual skills categories, ranging from 26% of tasks improved in the mobility category to 13% in the recognition category. The majority of patients with hemianopsia (n = 7) reported using the prisms at the 2-yr follow-up interview, but only 3 of them continued to drive and only 2 of the 3 continued to use their lenses for driving. | Participants were of heterogeneous age, older drivers were underrepresented, findings are not generalizable, no blinding was used, and no data on the long-term safety of device use while driving were provided for any of these participants. Attrition after 2 yr was high (n = 8). |
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<td>Freud &amp; Petrakos (2008)</td>
<td>(1) To determine how long error-specific driving restrictions might prolong driving time and (2) to determine whether restricted drivers had driving safety profiles similar to those of unrestricted drivers</td>
<td>II Prospective nonrandomized 3-group study</td>
<td>Intervention and education programs on use of a copilot, use of on-board navigation and crash warning systems, use of restricted licensing, use of self- and family-imposed driving restrictions, and use of cognitive enhancers. Control group received no intervention.</td>
<td>Time to an unsafe rating: Of the safe group, 4 became unsafe (3 after 360 days, 1 after 540 days). Of the restricted group, 4 became unsafe (1 after 180 days, 2 after 360 days, 1 after 540 days). Of the unsafe group, 10 remained unsafe. Time to an accident: No accidents were reported. Time to a traffic violation: One person in the safe driver category had a traffic violation after the 18-mo follow-up visit.</td>
<td>Generalizability of findings is limited. Selection bias is possible because of simulation technology (e.g., included only older adults who accepted new technologies, excluded participants who wanted to avoid on-road testing). Dropouts after Visit 1 included 3 (12.5%) safe drivers, 5 (42.9%) restricted drivers, and 6 (46.7%) unsafe drivers. Sample size was small.</td>
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<td>Man-Son-Hing, Marshall, Molnar, &amp; Wilson (2007)</td>
<td>To determine whether efficacious methods exist to reduce driving risk in people with dementia</td>
<td>I Systematic review of the literature</td>
<td>Intervention</td>
<td>Education programs: No intervention studies were found. Underlying memory and cognitive deficits, insight and judgment impairment, and progression of dementia make refresher courses not a reasonable option. Use of a copilot: No intervention studies were found, and conflicting opinions exist among experts on the use of copilots. Use of on-board navigation and crash warning systems: No intervention studies were found, but because of poor information processing, use of these technologies is unlikely to compensate for driving deficits.</td>
<td>No intervention studies were found, and recommendations were based on a cross-sectional study and a longitudinal prospective study.</td>
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<td>Use of restricted licensing or self- and family-imposed driving restriction: These measures are not recommended because drivers with dementia do not perform well in less predictable situations and may not have sufficient insight to understand the rationale for driving restrictions.</td>
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<td>Use of cognitive enhancers: No intervention studies were found. If clients demonstrate improvements in cognitive or functional status with use of cognitive enhancers, they must undergo a comprehensive on-road driving evaluation for decisions on driving.</td>
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**Notes:** AL = Alabama; Charron = Minnesota Clerical Test; CI = confidence interval; FIM = Functional Independence Measure; KEYS = Knowledge Enhances Your Safety; MVPT = Motor-Free Visual Perceptual Test; RCT = randomized controlled trial; SD = standard deviation; TRIP = Test Ride for Investigating Practical fitness to drive; TTKT = Traffic Theory Knowledge Test; UFOV = Useful Field of View.