



## Older Driver Physical Fitness

Driving is key to quality of life for many older adults. It helps them maintain independence, provides easy access to goods and services, and keeps them connected with friends and family. The loss of a driver's license can be a life-changing event, and has been associated with increased isolation and depression.

The development and progression of many age-related physical and cognitive declines can undermine older adults' ability to drive safely, thereby putting their licenses in jeopardy. Research has shown that age-related declines can be mitigated through improvements in physical fitness. Fitness programs for older adults offer multiple health benefits, and it is possible the positive effects include maintaining or improving the ability to drive safely. Research indicates better cardiovascular health increases executive function, attention, and processing speed, factors key to safe driving. NHTSA conducted two studies to explore the relationship between older adult physical fitness, as measured by functional abilities and activity levels, and driving performance and the amount and circumstances under which people choose to drive (exposure).

The first study, *Activity Level, Performance, and Exposure Among Older Drivers*,<sup>1</sup> examined the relationship between measures of older drivers' physical activity level, functional status, driving performance, and driving exposure among 67 drivers who ranged in age from 70 to 90. Participants were recruited from a senior residential community in Chapel Hill, North Carolina, in 2016.

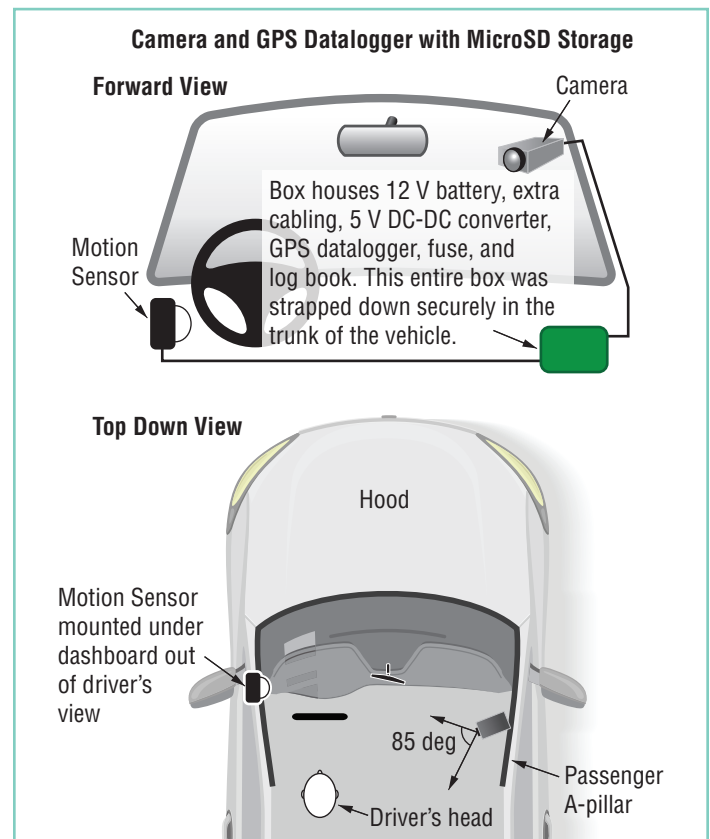
The research team combined physical activity measures describing participation in a multitude of physical activities as well as counts from a step tracker, to derive a single, continuous scale, the Unified Physical Activity Index (UPAI). Values could range from 1 (least active) to 100 (most active). Functional status measures included physical and cognitive attributes: head/neck/torso flexibility, leg strength, balance, visual search, and executive function.

A certified driver rehabilitation specialist (CDRS) evaluated participants' driving performance on a route that included suburban, urban, and commercial areas, with two-lane roads, four-lane arterials, and freeways. The CDRS scored the road test based on driver error counts that were weighted to account

for each error's implications for driving safety; for example, failing to signal a turn at an intersection cost the driver 3 points, coming too close to another vehicle while changing lanes cost 10, and running a red light was 100 points and failure of the driving test.

A GPS logger and a video camera installed in each participant's vehicle provided exposure data over about one month. The instruments logged the number and duration of trips, as well as vehicle speed. Video provided information about weather conditions, the presence of passengers, and driver behaviors such as mirror checks, side glances, and over-the-shoulder checks.

**Figure 1. Forward and Top-Down Views of Camera and GPS Datalogger**



The study found a relationship between measures of cognitive status and driving performance. Poorer performance on Trail-Making Parts A and B (a computer-administered test of visual search and executive function) were associated with poorer

<sup>1</sup> Staplin, L., Lococo, K. H., Gish, K. W., Stutts, J., & Srinivasan, R. (2019, September). *Activity level, performance and exposure among older drivers* (Report No. DOT HS 812 734). National Highway Traffic Safety Administration.

performance (total points off) on the road test ( $r = 0.14$  and  $0.20$ ). In addition, a logistic regression indicated that poorer performance on Snellgrove Maze 2 (a computer-administered test of executive function) and Trail-Making Part B were associated with statistically lower odds of passing the road test. However, the study did not show a relationship between physical activity level or other measures of functional status and driving performance or exposure. The results suggest that older adults' driving habits reflect patterns of behavior that they have acquired over decades of experience that are slow to respond to changes in physical fitness levels.

The second study, *Physical Fitness Training and Older Driver Performance and Exposure*,<sup>2</sup> examined whether inactive older drivers who took part in physical fitness classes would demonstrate improved driving performance as compared to a control group. Given research showing a relationship between cardio-vascular health and cognitive function in older adults and the results of the previous study linking cognitive skills to driving performance, the researchers hypothesized that a program of regular exercise to increase cardiovascular fitness could result in better driving performance.

Participants for this study were 30 drivers who ranged in age from 70 to 88. Twenty participants were assigned to a treatment group that took part in a physical fitness class one to two times per week over 23 weeks. The remaining 10 participants were assigned to a control group that met regularly over the same interval, but they did not exercise. Participants were recruited from a senior residential community in Chapel Hill, North Carolina, in 2018. Measures of physical activity, functional status, and driving performance and exposure were the same as used in the previous study.

Treatment effects were gauged in terms of "change scores," differences between scores obtained just prior to and immediately after the intervention period. Not surprisingly, change scores on measures of physical fitness indicated significantly greater participation by the treatment group in physical activities, as compared to the control group.

Analyses provided limited evidence of treatment effects on driving performance. Inferential statistical tests found no significant differences between the treatment and control groups in terms of changes in their driving performance or exposure. However, a technique generally used by engineers to evaluate the safety effect of crash countermeasures based on event counts found a significant improvement on tactical driving skills among treatment group members. Tactical driving skills

include things like monitoring other vehicles' movements, traffic signals, and the speedometer; staying in the proper lane, keeping a safe distance from other road users; responding appropriately to traffic signals; accelerating, braking, and steering smoothly; and obeying traffic laws. Physical fitness training may have improved these abilities by improving the driver's executive functioning, a cognitive process which supports complex task performance.

Absent the limitations and methodological challenges to completing this study, more robust findings may have emerged. A serious limitation of this study was a sample size; the research team was only able to recruit half the planned number of participants. Recruitment was hindered by older adults' reluctance to undergo formal driving evaluations that could, in extreme cases, lead to their losing their licenses. Some may also have been put off by the 6-month commitment required for study participation. Another challenge was that some participants discussed the test route characteristics and specific driving task requirements ahead of testing with others who had not yet completed testing.

And in spite of the theoretical justification, there is reason for skepticism that an increase in physical activity will lead to an increase in older persons' driving exposure. The preceding study led to the conclusion that reliable measures of older people's choices about when, where, and how often they drive primarily reflect habits acquired from many years of experience grounded in varied connections to the community, rather than an individual's momentary physical activity/fitness level.

The present findings combined with the results from the previous study provide only limited support for the hypothesis that increasing a previously sedentary older individual's level of physical activity may translate to better on-road performance, a surrogate for safety. While the use of increased physical activity as a traffic safety countermeasure was not supported by this research, the present findings underscore the need for continuing research aimed at identifying countermeasures to preserve older adults' independent mobility.

## How to Order

Download a copy of *Activity Level, Performance and Exposure Among Older Drivers* (115 pages), from <https://rosap.nhtl.bts.gov/view/dot/42285>, or *Physical Fitness Training and Older Driver Performance and Exposure* (88 pages); both prepared by TransAnalytics, LLC. Kathy Sifrit, Ph.D., was the task order manager for this project.

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<sup>2</sup> Staplin, L., Lococo, K. H., Stutts, J., Robison, K., Levitt, D., Srinivasan, R., & Sifrit, K. J. (in press). Physical fitness training and older driver performance and exposure. National Highway Traffic Safety Administration.



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