



Age-Related Functional Limitations, Countermeasures, and Crash Risks

This study updates and extends our understanding of how age-related functional deficits, including changes in vision, cognition, strength, and flexibility can increase older drivers' crash risks. The report discusses the potential of a variety of countermeasures to allow older drivers to accommodate to deficits, and thus continue driving safely. The central product of this research is a taxonomy table that displays links among functional limitations, countermeasures, and crash risk.

Crash Data Analyses and Literature Review

An analysis of the Fatal Analysis Reporting System (FARS) and National Automotive Sampling System/General Estimates System (NASS/GES) crash databases for the period 2002–2006 initially identified five crash types where older drivers were most overrepresented:

1. The driver turned left at an intersection with a two-way stop sign where the cross traffic was not required to stop.
2. The driver turned left at an intersection controlled by a traffic signal that displayed the unprotected green phase (no green arrow) as the driver approached.
3. The driver turned right at an intersection controlled by a yield sign in a channelized right-turn lane, merging with traffic approaching from the left on a principal arterial with speeds of 40 to 45 mph.
4. The driver merged onto a limited access highway from a ramp with an acceleration lane controlled by a yield sign.
5. The driver changed lanes on a roadway of four or more lanes.

A review of technical literature provided a detailed summary of research regarding age-related functional impairment, driving performance, and safety. The review included reports on the effects of medical conditions and medications on driving performance. A separate chapter addressed the effect of dementia on driving skills. The final chapter of the review covered evaluations of behavioral countermeasures

designed to help older adults drivers extend their years of safe driving.

Critical Driving Errors

The crash analyses and literature review pointed toward relationships among the five priority crash types for older drivers (listed above) and nine critical driver performance errors likely to result in these types of crashes:

1. Failing to detect potential conflicts, hazards, or traffic control information;
2. Misjudging gaps when crossing or merging into traffic;
3. Failing to predict the development of future conflicts based on current traffic and contextual information;
4. Delayed vehicle control response;
5. Inadequate visual search;
6. Slowed decision-making;
7. Not following the rules of the road;
8. Not using safe driving practices; and
9. Selecting an inappropriate response.

Specific sensory/perceptual (primarily visual), cognitive, and physical/psychomotor deficits were linked to these errors, as were countermeasures for addressing errors or deficits.

Taxonomy Table

Findings from the data analyses and literature review were used to develop a taxonomy table linking driver deficits to errors and then to crash types. An expert panel made recommendations to further refine the table. This table identifies critical performance errors implicated in crash types where older drivers are most strongly overrepresented, the functional deficits likely to underlie the performance errors, and countermeasures that hold the greatest promise to ameliorate or to accommodate those deficits.

Expert Panel

An expert panel of older-driver safety and mobility researchers and clinicians reviewed preliminary versions of the crash analysis report, the literature review, and the taxonomy table. The panel gathered for a day-and-a-half meeting, discussed the preliminary documents, and recommended corrections and refinements. During the final session, panelists discussed strengths and weaknesses of a variety of countermeasures identified in the literature and suggested by panelists until they reached consensus on each countermeasure's potential to improve older drivers' safety.

Older Drivers' Comments

Discussions with 50 older Maryland drivers provided another perspective on the efficacy and acceptability of behavioral countermeasures. Half these participants had experienced crashes in the past three years; the other half had not. Participants in each group described their driving habits, difficult driving situations, and strategies they used to avoid or compensate for the difficult situations. The participants' comments did not indicate that the crash-free group had a better understanding of driving hazards associated with functional aging, and the crash-free group did not demonstrate greater reliance on strategies to avoid risky situations.

Conclusions

The final report, *Taxonomy of Older Driver Behaviors and Crash Risks* provides information about specific risk factors and potential means to reduce the risk. This will be useful to researchers, health care practitioners, and others concerned about older driver safety. The hard copy of the report includes a summary version of the taxonomy table, and the electronic version of the report contains an expanded, electronic form of the table.

Conclusions drawn from this project include:

- Most of the critical driver performance errors identified in the study could result in any of the five major crash types for older drivers identified in the FARS and GES analyses. This suggests that countermeasures that address a functional deficit may reduce risk for a number of crash types. For example, a driver with poor contrast sensitivity due to cataracts might not see well enough to notice cues about

changing traffic situations particularly on a cloudy day. The driver might not detect a neutral-colored vehicle, or a stalled vehicle at the side of the roadway and interfering with traffic flow. This could result in any of the five major crash types. Successful cataract surgery could allow the driver to see adequately to avoid these errors and thereby reduce his or her crash risk.

- Older drivers made efforts to compensate for the functional limitations they were aware of. However, most of the older drivers were unaware of the consequences of functional aging on driving task performance. This suggests a significant opportunity to improve safety through appropriate educational interventions.
- A driver must be willing and able to apply any strategy or countermeasure that is not automatic. Ideally, a rehabilitation professional should evaluate a driver's performance and determine whether an intervention is indicated. If the driver's performance warrants a countermeasure, the rehabilitation professional should guide the driver in identifying one that is appropriate and train the driver to use it appropriately.
- There are risks associated with recommending devices or strategies to support specific tasks in order to keep drivers with functional impairments driving. Future research should identify countermeasures for age-related limitations that drivers can appropriately obtain outside of a formal rehabilitation context as opposed to those that a driver should only adopt under a driving rehabilitation professional's supervision.
- A driver with both memory loss and another type of impairment must receive strategies to address both issues. Most countermeasures require intact cognition to realize safety and performance gains.

How to Order

To order *Taxonomy of Older Driver Behaviors and Crash Risks* (58 pages), prepared by TransAnalytics, LLC, write to the Office of Behavioral Safety Research, NHTSA, NTI-130, 1200 New Jersey Avenue SE., Washington, DC 20590, fax 202-366-7394, or download from www.nhtsa.gov. Kathy Sifrit, Ph.D., was the project manager.



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