

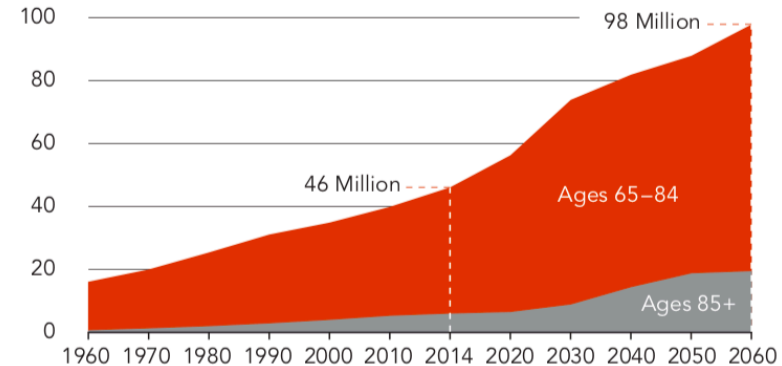
Debate

To maintain a valid driver's license, all individuals age 65 and over should complete biennial cognitive assessments

Driving in an aging population

- Increasing life expectancy in US:
 - 79 years
 - 15% of population is 65+, projected to rise to 24% by 2060
- Increase of drivers above 65 years:
 - ~ 86% have an active license to operate a motor vehicle
- Neurocognitive disorders
 - > 47 million people with dementia worldwide → 131 million by 2050
 - Dementia: 14% of people age 71+ in the US
 - MCI: 20% of people age 70+

U.S. Population Ages 65 and Older, 1960 to 2060 (Millions)



Source: PRB analysis of data from the U.S. Census Bureau.

Age-related changes that may affect driving



- Musculoskeletal problems
- Pain
- Vision problems
- Hearing problems
- Medications
- Cognitive changes: slower reaction time, reduced attention, working memory, and executive function

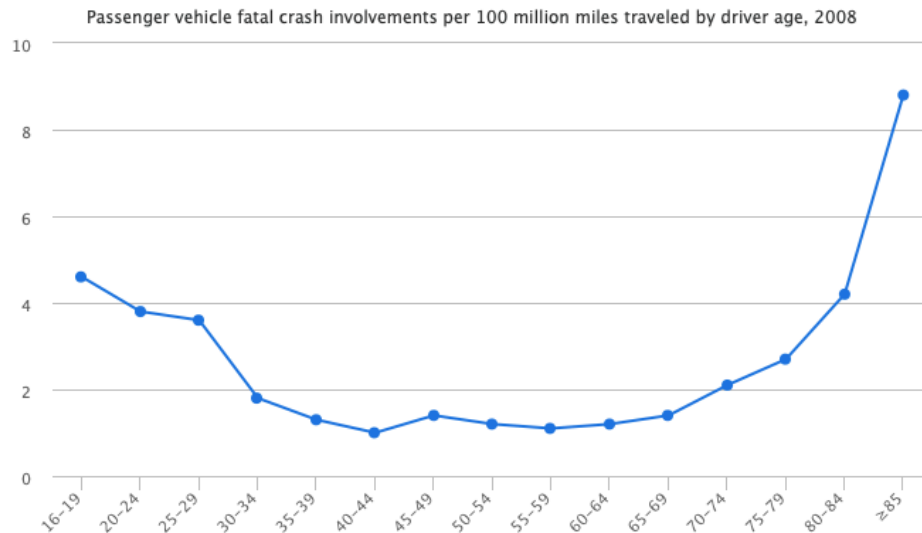
Scott, K. A., Rogers, E., Betz, M. E., Hoffecker, L., Li, G., & DiGuiseppi, C. (2017). Associations Between Falls and Driving Outcomes in Older Adults: Systematic Review and Meta-Analysis. *Journal of the American Geriatrics Society*, 65(12), 2596-2602.

Harada, C. N., Natelson Love, M. C., & Triebel, K. L. (2013). Normal cognitive aging. *Clinics in geriatric medicine*, 29(4), 737-52.

<https://www.nia.nih.gov/health/older-drivers>

Age and driving safety

- Older adults without diagnosed disease may experience physical, sensory, and cognitive changes that can interfere with driving
- They are also more likely to have medical conditions that impact driving safety
- Behind-the-wheel tests suggest global driving performance declines over time in cognitively healthy older adults
- Fatal crashes per mile increase from age 70-74; highest above age 85



<https://www.ihs.org/ihs/topics/i/older-drivers/fatalityfacts/older-people/2016>

Boot, W. R., Stothart, C., & Charness, N. (2013). Improving the safety of aging road users: a mini-review. *Gerontology*, 60(1), 90-6.

https://www.cdc.gov/motorvehiclesafety/older_adult_drivers/index.html

<https://www.cdc.gov/motorvehiclesafety/calculator/factsheet/licenser renewal.html>

Cognitive impairment and driving safety

- Driving is complex and dynamic activity
 - Safe driving requires several cognitive skills → Executive functions
- Cognitive function and performance of people with dementia declines over time, which may result in an increased risk of injuries.
- People with MCI or dementia are 2-10 times more likely to die in traffic incidents while driving



Miller SM, Taylor-Piliae RE, Insel KC. The association of physical activity, cognitive processes and automobile driving ability in older adults: A review of the literature. *Geriatr Nurs (Minneap)*. 2016;37(4):313–20.

Anstey KJ, Eramudugolla R, Chopra S, Price J, Wood JM, Bondi M. Assessment of Driving Safety in Older Adults with Mild Cognitive Impairment. *J Alzheimer's Dis*. 2017;57(4):1197–205

Effects of dementia on driving ability

Relevant cognitive domains

- Memory
- Language skills
- Judgment and decision-making
- Spatial perception
- Attention
- Vision
- Motor skills

Issues while driving

- Getting lost
- Having difficulties at intersections
- Confusing the pedals
- Maintaining speed poorly
- Straying from designated lanes
- Poorer safety judgment
- Impaired capacity to self-monitor and self-regulate driving

Dementia and driving safety



- Postmortem studies have identified neuropathological changes associated with Alzheimer's disease in many older drivers killed in car crashes
- Preclinical Alzheimer disease in 30%:
 - Without concurrent detectable dementia symptoms
- Impact of being involved in a non-fatal accident may be greater for those with reduced cognitive and physical reserves

Roe CM, Babulal GM, Head DM, Stout SH, Vernon EK, Ghoshal N, et al. Preclinical Alzheimer's disease and longitudinal driving decline. Alzheimer's Dement Transl Res Clin Interv [Internet]. 2017;3(1):74–82.

Some current methods of driving assessment

Measures	Description	Driving performance pro(s)	Driving performance con(s)
Behind-the-wheel exam (BTW) (Also known as performance-based road assessments)	On-road test conducted by a driving specialist who observes and directs the driving of the examinee	Direct measurement of driving on the road Face validity Qualitative and quantitative measurement Has been associated with at-fault crashes	Subjectivity with qualitative measurements Traffic conditions can change affecting standardization Safety concerns in a “real-world” setting Routes may not generalize to typical “at home” driving environment (city vs rural driving)
Crash statistics	Data gathered from collisions and possible contributing factors	Very strong clinical relevance	Infrequent events Usually does not account for accidents that are not reported to the authorities Data collected after the fact At-fault information on crashes not easily accessible/available
Self-report questionnaires	Self-report of driving history (e.g., nonreported accidents, violations, driving behaviors)	Easily obtained information Family/significant other questionnaires can often provide valuable information	Limitations of self-report include over- and underestimation of events Self-report not beneficial if patient insight deficits exist

Manning, Kevin J., Peggy P. Barco, and Maria T. Schultheis. "Driving evaluation in older adults." *Handbook on the Neuropsychology of Aging and Dementia*. Springer, Cham, 2019. 231-251.

We need driving-related **cognitive** assessments!

► **Table 1** Cognitive/sensory functions needed for driving.

Visual information selection
Visual perception (including contrast and darkness vision)
Visual attention
Visuospatial skills
Divided and sustained attention
Executive functions (planning, anticipation, adaption to new situations)
Speed of processing
Episodic, semantic, procedural, and prospective memory

► **Table 2** Elements of driving assessment in the elderly.

Evaluation of overall functioning
Medical history (with regard to driving and dementia-related problems)
Medical history by proxy (with regard to potentially dangerous driving behavior)
Neurocognitive testing (with focus on attention, visuospatial skills, and reaction times)
On-the-road test

Why biennial?

- Progression of MCI/Dementia over time: estimated average three-year lag between symptoms and diagnosis
- Driving risks may go unnoticed in early stages of dementia, since symptoms appear sporadically
- Even pre-clinical Alzheimer's (i.e. amyloid and tau) linked to driving problems
- As the disease progresses, people may be less aware of their driving limitations

Conclusion: Independence vs Safety

- Stopping driving may have negative effects on health, including physical, psychological, and social wellbeing
- But the impact of being responsible for harming someone while driving is significant too, both psychologically and financially (insurance may not cover those with known cognitive impairment)
- We should normalize “driving retirement” and invest in better alternative forms of transportation for older adults
- Our priority should be the safety of the whole community

Closing Argument



“To maintain a valid driver's license, all individuals age 65 and over should complete biennial cognitive assessments”

WHY?

- People live longer- life expectancy increased in last decades
- More older adults with active license ($\geq 65y$: 86% in 2016)
- With aging, general decline in health
 - More people with cognitive impairment
- Cognitive decline linked to increased risk of crashes (Fraade-Blanar et al., 2018).
 - Figure 2, next slide- Not only people with CI, but also healthy/independent people

Cognitive decline associated with higher crash risk

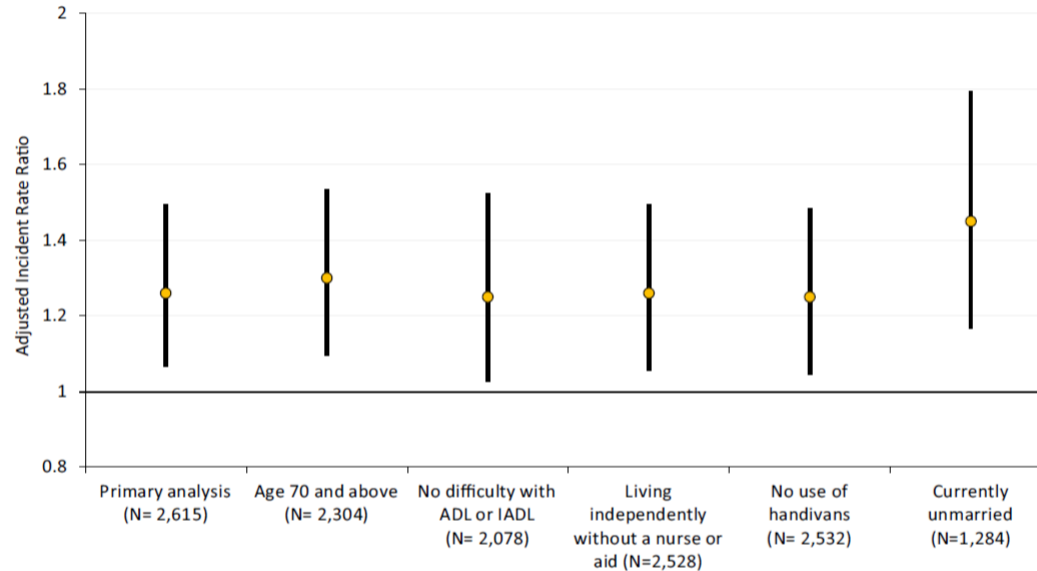


Figure 2. Point estimates and 95% confidence intervals for the adjusted incident rate ratio of crash associated with a 1-unit difference in Cognitive Abilities Screening Instrument scored using item response theory score for the primary analysis and sensitivity analyses. N refers to the number of clusters included in each analysis

“To maintain a valid driver's license, all individuals age 65 and over should complete biennial cognitive assessments”

WHY?

- Need of a uniform procedure for identifying people at risk.
 - Current state of the law depends of the place
 - For example: in CA, DE, NJ, NV, OR, PA- it is required physicians report unsafe drivers
 - “Lack of agreement among licensing authorities and medical practitioners regarding the level of impairment that indicates when a driver is no longer fit to drive...”
 - “Many clinicians are reluctant to make decisions about driving because of concerns that this interferes with the doctor–patient relationship.” (Meuleners et al., 2016)
- “Driving is a state-given privilege that ultimately can be revoked only by the state.” (Brown et al., 2004)

“To maintain a valid driver's license, all individuals age 65 and over should complete biennial cognitive assessments”

No! WHY?

- “Risk is not so high.”
 - IRR (95% CI): 1.26 (1.07, 1.48)
- “There is no enough/conclusive evidence.”

“...older adults may be licensed but choose not to drive or to limit driving exposure in terms of mileage or environment, especially as cognition declines and other health conditions advance. **This would result in an underestimation of the true crash risk.**”

- “A cognitive test is not a good indicator of poor driving performance.”

“Healthcare providers and state licensing departments of older adults with early-stage dementia may consider them **able to drive, and they may pass driving tests.**”

- Failing a test could lead to people not driving anymore.
 - Driving cessation associated with poor health outcomes.
 - Accelerated cognitive decline.
 - Bidirectional? (Choi et al., 2014)

“Cessation is associated with negative health outcomes, including isolation, depression, early entry into a long-term care facility, and caregiver burden, **although a crash can be devastating or deadly for fragile older adults and other road users.**”

(Fraade-Blanar et al., 2018)

Don't Ruin My Life — Aging and Driving in the 21st Century

Louise Aronson, M.D.

From the Division of Geriatrics, Department of Medicine, University of California, San Francisco, San Francisco.

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- “And I well remember watching her march down our clinic’s long hallway and through the glass front door toward the car she would almost certainly have to stop driving sometime soon, since, as required by California law, I would report her new dementia diagnosis to the Department of Motor Vehicles.”
- “Not driving wasn’t simply not driving. It was a reduction of status and freedom, independence and opportunity.”

But we believe this is preferable to her continuing to drive at a higher risk of hurting herself and others.