Seniors face serious driving safety and mobility issues.

Keeping Older Adults Driving Safely: A Research Synthesis of Advanced In-Vehicle Technologies

A LongROAD Study

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Title

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About the Sponsor

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About LongROAD

Safe mobility is essential to healthy aging. Recognizing that lifestyle changes, along with innovative technologies and medical advancements, will have a significant impact on the driving experiences of the baby boomer generation, the AAA Foundation for Traffic Safety has launched a multi-year research program to more fully understand the driving patterns and trends of older drivers in the United States. This multi-year prospective cohort study is being conducted at 5 sites throughout the country, with 3,000 participants, tracking 5+ years of driving behaviors and medical conditions. The multidisciplinary team assembled to investigate this issue is led by experienced researchers from Columbia University, University of Michigan Transportation Research Institute and the Urban Institute.

The LongROAD (Longitudinal Research on Aging Drivers) Study is designed to generate the largest and most comprehensive data base about senior drivers in existence and will support in-depth studies of senior driving and mobility to better understand risks and develop effective countermeasures. Specific emphasis is being placed on issues related to medications, medical conditions, driving patterns, driving exposure, self-regulation, automotive technologies, and crash risk, along with mobility options for older Americans who no longer drive.

Abstract

Background
Advanced in-vehicle technologies have been proposed as a potential way to keep older adults driving for as long as they can safely do so, by taking into account the common declines in functional abilities experienced by older adults.

Objectives
The purpose of this report was to synthesize the knowledge about older drivers and advanced in-vehicle technologies, focusing on three areas: use (how older drivers use these technologies), perception (what they think about the technologies), and outcomes (the safety and/or comfort benefits of the technologies).

Methods
Sixteen technologies were selected for review and grouped into three categories: crash avoidance systems (lane departure warning, curve speed warning, forward collision warning, blind spot warning, parking assistance, intersection assistance, merging assistance); in-vehicle information systems (navigation assistance, congestion warning, intelligent speed adaptation); and other systems (adaptive cruise control, automatic crash notification, night vision enhancement, adaptive headlight, voice activated control, drowsiness/fatigue warning). A comprehensive and systematic search was conducted for each technology to collect related publications. 298 articles were included into the final review.

Results
Research findings for each of the 16 technologies were synthesized in relation to how older adults use and think about the technologies as well as potential benefits. These results are presented separately for each technology. The paper also addressees training, education, and research needs.

Conclusions
Can advanced in-vehicle technologies help extend the period over which an older adult can drive safely? This report answers this question with an optimistic "yes." Some of technologies reviewed in this report have been shown to help older drivers avoid crashes, improve the ease and comfort of driving, and travel to places and at times that they might normally avoid. Other technologies show promise for providing benefits to older drivers and the development of these technologies continues.

Introduction

For decades demographers have predicted the aging of the United States (US) population and the effects that this demographic shift will have on society. Indeed, with the first Baby Boomers reaching the age of 70 in 2016, this so-called "aging tsunami" (Seville, 2014) has arrived and will continue for several decades. The world's population is also aging. According to the report "Global Health and Aging" (National Institute on Aging, NIA, 2011), the world's population is older now than at any other time in history. By 2016, the global number of older adults (aged 65 and older) will be greater than the number of children age 5 and under, with projections showing that the number of older adults will increase from 524 million in 2010 to 1.5 billion in 2050 (NIA, 2011).

Aging and Driving

As the global population continues to grow older, the personal automobile will increasingly be the preferred mode of personal mobility (Eby & Molnar, 2014). The reasons for this trend are numerous. First, in the US and in many other countries, the coming cohort of older adults tend to link driving a personal automobile with continued independence and a high quality-of-life (Molnar & Eby, 2009). Second, studies on older adults have found that an association between driving cessation and declines in well-being and many other important health measures (Chihuri et al., 2015; Edwards et al., 2009; Marottoli et al., 1997; Ragland, Satariano, & MacLeod, 2005; Windsor et al., 2007). Third, in nearly all countries, the licensure rate for older adults is increasing and will likely continue to increase (Sivak & Schoettle, 2011). Fourth, in addition to the increasing number of licensed older adults, this age group is expected to drive more than previous cohorts (Buehler & Nobis, 2010; Santos, McGuckin, Nakamoto, Gray, & Liss, 2011). Finally, non-driving community mobility options are lacking or insufficient in many locations (McGuckin & Srinivasan, 2003), particularly in rural areas where a higher concentration of older adults are located (Kostyniuk et al., 2012). Thus, for most older adults the automobile is the only viable option for personal mobility whether they are a driver or a passenger.

Crashes

The debate continues about whether older drivers are at a greater risk of a crash when compared to drivers age 25-64 years (see e.g., Alvarez & Fierro, 2008; Eby, Molnar, & Kartje, 2009; Hakamies-Blomqvist, Raitanen, & O'Neill, 2002; Insurance Institute for Highway Safety, IIHS, 2014; Langford, Methorst, & Hakamies-Blomqvist, 2006; Staplin, Gish, & Joyce, 2008). There is, however, general agreement that older adults are at higher risk for fatal crashes. Figure 1 shows the fatal crash rate per 100 million miles traveled by age group in the US in 2008 (IIHS, 2013). Fatal crash rates declined up to about age 30 and then sharply increased after age 69.

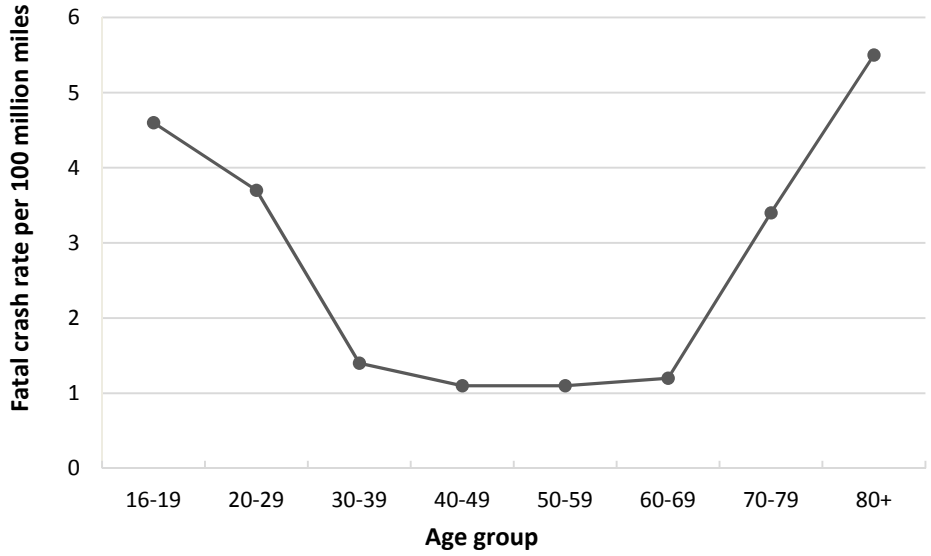

Figure 1: Passenger Vehicle Fatal Crash Rates per 100 Million Miles Driven by Driver Age Group for the US in 2008. Data are from IIHS (2013).

Several studies have documented that older adults are involved in different types of crashes than younger drivers, in particular intersection crashes (see e.g., Abdel-Aty & Radwan, 2000; Clark, Forsyth, & Wright, 1999; Cooper, 1990; Hakamies-Bloomqvist, 2004; Langford & Koppel, 2006; Larsen & Kines, 2002; Oxley, Fildes, Corben, & Langford, 2006; Staplin, Lococo, McKnight, McKnight, & Odenheimer, 1998). Figure 2 shows fatal crash data from the US in 2013 by intersection versus non-intersection crashes for single and multiple vehicles by age group (IIHS, 2013). The graph shows that the percentage of all fatal crashes involving multiple vehicles at intersections increases consistently after age 30 with a steep increase after age 79, while no increase was found for single-vehicle intersection crashes across the lifespan. Considering non-intersection crashes (dashed lines), there was a consistent reduction in the percentage of fatal non-intersection single vehicle crashes with age and a steep decrease in the percentage on non-intersection multiple vehicle crashes after age 79. Thus, these data support the notion that intersections with traffic pose a significant safety risk for older drivers.