More road to travel by: Implications for mobility and safety in late life

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R. A. Barr, More road to travel by: Implications for mobility and safety in late life. Gerontechnology 2002; 2(1): 50 - 54. The 'suburbanization' of the United States is now generating a cohort of older adults who live where driving is most often the sole means of transport to all of the external necessities and conveniences of daily life. As suburbs grow further out from cities so the distances to be driven by future cohorts of older drivers will increase beyond those of today. Much research on driving in late life has focused on assessing the competence of older adults as drivers. Now more work is needed on technological solutions to maintaining this cohort's driving mobility and safety. The presentation reviews recent changes in transportation technology (such as airbags), considers lessons learned from them in terms of their effects on older drivers and passengers and considers whether current knowledge of older drivers and their driving patterns offers guidance to the design of future technology.

Key Words: driving, driver assessment, mobility, safety

People in the United States have been moving to the suburbs for over 50 years. Gaquin and Littman[1] reported that in the years 1950 to 1998 the percentage of the metropolitan population living in the city (as opposed to the suburbs) declined from 57% to 35%. In recent years these statements must be qualified. Using 2000 census data, for example, Glaeser and Shapiro[2] report that cities experienced median growth in the 1980s and more substantial median growth in the 1990s. Lucy and Phillips[3] reported that some suburbs experienced decline in population in the 1990s. Yet these two recent reports reveal continuity with the earlier pattern of suburbanization in one particular way – an increasing dependence on the automobile. Glaeser and Shapiro[2] report that cities where the substantial majority of commuters drive alone grew by more than 12%, whereas cities where less than 65% of commuters drive alone grew by less than 2%. Cities where more than 10% of commuters took public transportation to work saw almost no growth. In contrast, growth was almost 17 % in cities where less than 3% of people use public transportation to get to work. The pattern of growth in driving-oriented cities leads to the familiar problems of clogged roads and pollution. However, Lucy and Phillips[3] saw a particular pattern to suburban growth in the 1990s that clearly implies more as well as busier roads. They reported that population growth was substantially faster in unincorporated areas and in new suburbs around cities than in existing suburbs. The population in new suburbs and unincorporated areas in the 1990s increased by 21.7%. Total suburban population growth was 14.2%. New suburbs and unincorporated areas generate new roads within the new developments and also generate substantial stretches of expanded roads connecting these outlying areas to the major centers of employment and services within the urban area.

What do these changes have to do with aging? 'Aging in place' remains the pervasive pattern of residential aging in this country[4-5]. For example, the aging of the first post-World War II suburban homeowners gener-

ated the first cohort of suburban older drivers whose primary mode of shopping, entertainment, and access to health services was via car. As the shift to driving-oriented residential environments continues even as metropolitan areas experience some revival in population, driving will remain the lifelong means of satisfying daily needs and desires in present and future cohorts of older adults. Furthermore, as older adults reside in increasingly outlying suburbs they become more separated from each other and from the centers of services in urban and suburban areas. Therefore the provision of home-based services to these adults as a group is becoming more expensive. Service-providers find it much more economical to concentrate services in a single center and instruct clients to visit the center. Thus driving becomes essential to accessing needed health services and to remaining socially connected.

Barr[6] proposed that driving is becoming an instrumental activity of daily living (IADL) for many older Americans. The loss of IADLs (such as ability to prepare meals, or manage money) is disabling to older adults[7]. IADL loss is strongly associated with formal health care use and mortality as well as depression and social isolation[7-8]. Barr proposed that a critical difference between an IADL and a facilitator (such as social support) is that loss of the IADL, unlike loss of a facilitator, has irreplaceable psychological consequences. No longer being able to prepare meals is not compensated by the availability of a meals-on-wheels service or similar source of nutrition. For many women, and perhaps a few men, losing the ability to cook and prepare food is a loss in itself even if daily nutrition needs are being met by other means. In the same way the loss of driving, or even the substantial curtailment of driving represents a loss to older men and women that is not compensated by the availability of alternatives means of transportation. Consistent with that perspective, Fonda, Wallace and Herzog[9] reported that the presence of a spouse, who was able to provide an alternative means of satisfying mobility needs did not alleviate the depression among older adults who had ceased to drive or had reduced their driving.

Gerontechnology cannot be expected to solve all the problems that the socially creat-

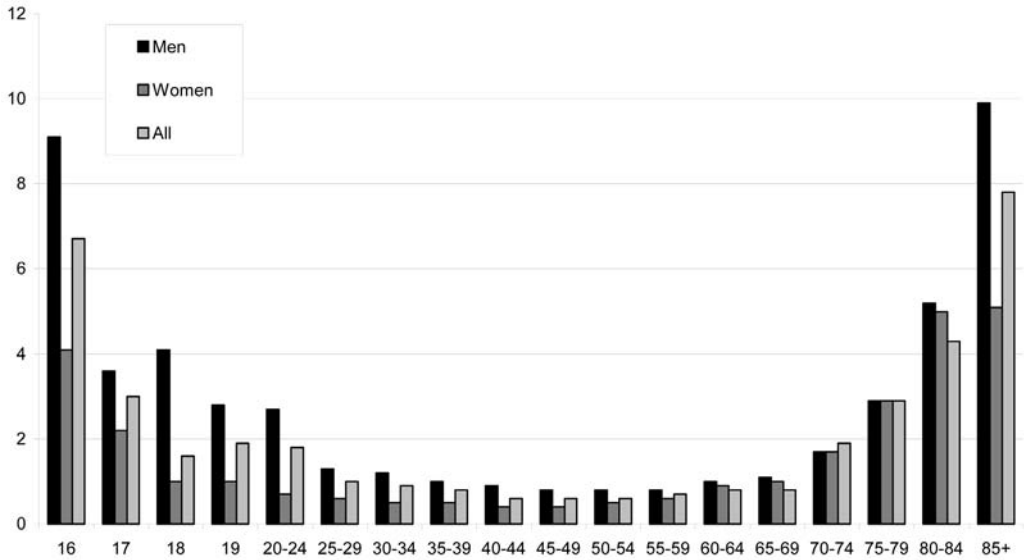

Figure 1. Fatality rate per 100 million miles traveled by age of decedent. (1996 FARS data)

ed need to drive engenders when individuals become too frail, or suffer declining skills that make them unable to drive safely. Therefore it is important for the field to focus on areas where our science and technology can make a substantial difference to older adults. The compelling evidence of national trends that continue expanding the role of driving in our lives leaves little doubt that a major priority for gerontechnology must be finding ways to ensure the continuing safe mobility of older adult drivers. Clearly the field has a role in the technology of assessing competence to drive. Nevertheless the value to older adults and to society more generally of finding ways to continue safe mobility surely is much greater than the value of improved technology to assess competence.

One area where gerontechnology research is needed is injury prevention and injury reduction following a crash. Figure 1 is the familiar 'U' in driving safety research. It shows 1996 data from the Fatal Accident Reporting System (FARS) that records all traffic-related deaths within 30 days of a crash in the United States. The figure expresses motor vehicle deaths as a function of miles traveled by drivers of a particular age. Both men and women over the age of 85 show the highest rate of fatal motor vehicle injury of any age group, including teenagers. The figure is often cited as a primary justification for an emphasis on safety and for policies that will regulate driving in old age. Consider Figure 2, though. The same deaths reported in Figure 1 (1996 data from FARS) are shown in this figure. However, Figure 2 shows deaths in crashes involving drivers of particular ages. Figure 2 assesses deaths as a function of driver age instead of as a function of the age of the person killed in the crash (as in Figure 1). Figure 2 also does not adjust death rates as a function of miles driven by different age groups (as Figure 1 does). In Figure 2 it is clear that increasing age is associated with decreasing responsibility for deaths on the road and that drivers over age 85 are responsible for a tiny fraction of the number of deaths consequent to driving by teenagers. The differences between the two figures are brought about both by the fact that older drivers drive many fewer miles than younger drivers and by the substantially increased vulnerability of older adults to fatal injury when involved in a car crash of given severi-

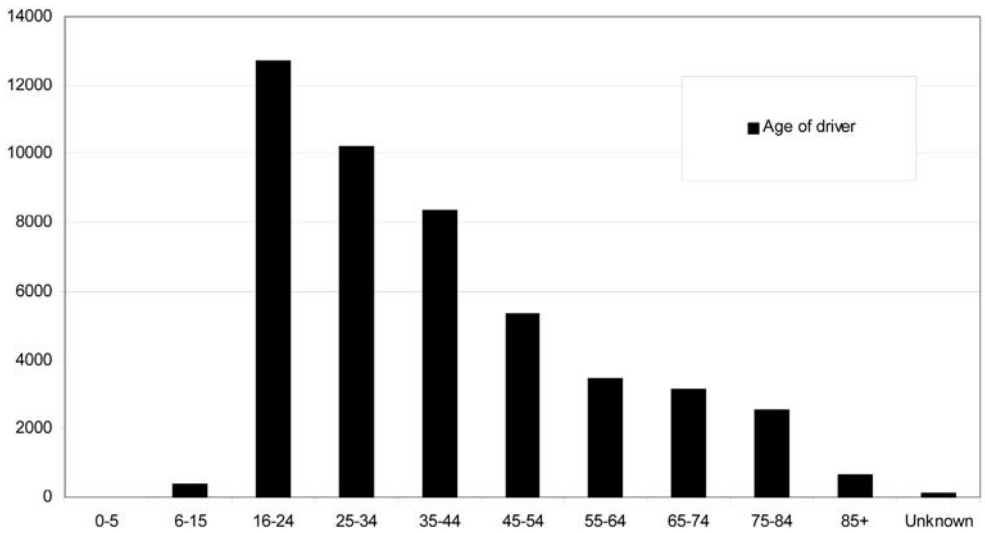

Figure 2. Deaths in crashes involving drivers of different ages (1996 FARS data)

ty. Figure 1 represents a challenge to the gerontechnology community. Can engineering cars for elder-safety change the shape of the U?

A second area for gerontechnology research on driving is crash prevention. Progress has been made already in this field. Kline[11] has offered guidelines for creating ergonomically correct visual task environments for older observers that may be applied either to design of highway signs or to in-car display signs. Kline and Fuchs[12] proposed that low-pass spatial frequency symbolic signs offer significant advantages in detectability for both older and younger drivers over text or high-pass spatial frequency signs. More recently Ho, Scialfa, Caird and Graw[13] explored older and younger adult's ability to distinguish highway signs embedded in visual clutter as might be encountered in urban and suburban driving environments. All participants showed decreased search efficiency in cluttered environments. Older adults showed a proportionate decrease in search efficiency relative to younger adults in both cluttered and uncluttered environments. Though continued research on improving highway signs, the effects of visual clutter, visibility of lane markings in wet weather, and other features of the constructed highway environment will continue to benefit older adults, gerontechnologists need to focus particularly on the more rapidly changing within-car technologies that are designed to reduce the demands of driving. Are in-car navigation systems a hindrance or help to older adults whose use for them may be limited? Are infra-red night vision displays useful to older adults or do changes in vision with increasing age mean that these systems primarily benefit younger drivers? More useful still would be design guidelines that go beyond Kline[11] to offer car designers models for older adult drivers and passengers. Given the range of abilities, sizes, frailty and strengths of older adults, guidelines might be better focused either on several models of different older adults or on reflecting the range on key variables that may be relevant to driving situations.

A third area for gerontechnology research on driving is the evaluation of mandated changes in cars, highway design, and driving laws for their effects on the safety and mobility of older adults. Though this area goes beyond gerontechnology, nevertheless the field has much to offer the evaluation. For example, airbags were both mandated in driver-side and then passenger-side positions in new vehicles, and then, in 1997, new softer-impact airbags were introduced, partly with the purpose of helping to protect frail older adults who may be injured by the airbag. Did airbags save older adult lives? Do softer impact airbags save more older adult lives? Does the pattern of older adult experiences when airbags are activated suggest ways to improve their design? Does the experience of introducing airbags offer lessons in how future safety technologies may be introduced to benefit older drivers and passengers?

In conclusion, gerontechnology can play a large and important role in improving driving in late life. The most substantive contributions will come from focusing applications of gerontechnology to the task of maintaining mobility and safety in the later years of life. The overwhelming and increasing importance of driving in the United States has now raised it to the level of an instrumental activity of daily living. As such, loss of this ability represents the greater threat to our society than the threat of crashes involving older adults. Though such crashes cannot be ignored they should not dominate our research on driving in late life. We must also focus on how technology can be used to foster safe driving throughout adult life.

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