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Transit Use Viability Among Older Drivers Losing Driving Privileges

TECHNICAL MEMORANDUM ONE

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16. Abstract Effective January 1, 2004, Florida Statute 322.18, subsection 5, requires drivers 79 years or older to pass vision tests when renewing their six-year licenses. Such a mandate is part of an “age-based” testing regime that several U.S. states have implemented in recent years with respect to enhancing the safety environment afforded to road users. Implementation of “age-based testing” produces a group of travelers who could provide a resource in understanding travel behavior changes and mode choice after driving cessation. The objective of this study is to provide additional insight into travel behavior changes for persons who lose their driving privileges, particularly their interest in, ability to, and subsequent use of public transit. This technical memorandum documents work on the envisaged tasks required to meet the study objectives, namely: 1) an introduction to the problem, 2) a comprehensive literature review, and, 3) a discussion of project methodology options and potential recommendations.			
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INTRODUCTION

This Technical Memorandum is the first deliverable in the Florida Department of Transportation (FDOT) project titled Transit Use Viability Among Older Drivers Losing Driving Privileges, contract BD 549-17. This project, part of the work program of the National Center for Transit Research (NCTR) funded by FDOT, is intended to explore driving cessation in Florida and the potential opportunities for meeting the mobility needs of older Floridians who relinquish their driver privileges in their later years. Specifically, this research effort will undertake the following six tasks.

Task 1: Relationship with Other Agencies

The task involves a series of meetings with various agencies to explore the availability of data, critical policy issues and early experience since the Florida vision testing program took affect (i.e., as from 1 January 2004). Among the groups contacted are the National Older Drivers Research and Training Center, the Florida At-Risk Driver Council, and the Florida Department of Highway Safety and Motor Vehicles. Various older person interest groups also may be contacted as possible partners or sources of information on the affected population.

Task 2: Literature Review

Several bodies of literature can be consulted to develop a strong contextual knowledge that will both help shape the data collection phase and enable the researchers to better understand how the findings from this work can be generalized to a larger population or context. The literature areas to be consulted include driving cessation, both voluntary and forced; travel arrangements after cessation; role of transit in these arrangements; design of survey instruments/data collection for the senior population; and lessons in conducting surveys of older persons.

Task 3: Research Design

This task involves refining the actual data collection and analysis plan in light of the project goals, knowledge about legal and practical experience in collecting this type of information from this population, and possible data processing methods. An initial step is to determine working hypotheses. The research team will explore various data collection strategies such as surveys, interviews, and focus groups. The possibility of travel diaries, exploration of how one might collect information about prior travel, and the prospect of doing longitudinal data collections (resurvey after a period of time to see how behavior has changed) will also be explored.

Task 4: Identifying and Locating Older Drivers

Task 1 will resolve the issue of availability of access to records of licensees who failed their vision exam. The prospect of identifying situations where there is a voluntary relinquishing

of licenses will also be explored. Alternative strategies for enrolling drivers who relinquished their licenses will also be explored. Task 3 will then develop a sample or enrollment strategy given the available information. This task will also design a strategy for obtaining commitment for participating in the research from potential respondents.

Task 5: Conducting Surveys

This task will involve carrying out the resultant data collection strategy(ies).

Task 6: Data Analysis

This task will involve analyzing the data. This may include some statistical analysis as well as qualitative analysis of the data. It is envisioned that there would be substantial descriptive information produced as well as interpretation of the data by the project team in terms of the policy implications in general and specifically with respect to public transit.

At the completion of the above tasks, the final task will involve documenting the project and its findings and producing a final report.

This first technical memorandum documents work on the first three tasks of this 6-task, 13-month research effort. This technical memorandum consists of three major sections: 1) an introduction, 2) a comprehensive literature review, and, 3) a discussion of project methodology options and recommendations. Following review of the document and additional analysis of forthcoming data from the Florida Department of Highway Safety and Motor Vehicles (HSMV), a decision on project methodology will be made by the project team subject to FDOT's concurrence. The quarterly report (April – June 2005) also lists names of individuals who have been identified as possible participants in the project oversight committee, which will provide the Center for Urban Transportation Research (CUTR) with additional review of study products.

Context

Effective January 1, 2004, Florida Statute 322.18, subsection (5), required drivers over 79 years of age to pass vision tests when renewing their six-year licenses. Such a mandate is part of "age-based" testing regime that some U.S. states have implemented in recent years with respect to enhancing the safety environment afforded to road users. Florida, long known as a Mecca for retirees, currently has an estimated 710,000 drivers 80 years or older and who have a class A, B, C, D, E or O license (personal communication with M. Grosz of HSMV). As the fourth largest state and one with the highest average age, Florida has a strong interest in gaining a full understanding of the mobility needs of the older population and the implications of driving cessation.

Mobility providers, public transportation operators foremost among them, can benefit from a better understanding of the number and mobility needs of the market of individuals who may

be ceasing to drive. If just 1 percent of older drivers were to fail the vision test annually, the result would be about 7,000 drivers who need to look for alternative modes of transportation to remain active in their communities. However, it should be noted that “the literature has not yet provided estimates of the current or future incidence of driving cessation” (Waldorf, 2001). Public transit, if available, can be a viable option for many individuals. Although taken off the road for poor vision reasons, many of them still may be physically able to use transit. This new law will produce a group of travelers that could provide a great resource in understanding travel behavior changes and mode choice after driving cessation. Knowledge of this group will provide valuable insight into travel and transit use by the growing population of older Americans. A richer understanding of driving cessation and accommodation will enable informed planning and policy making to support the mobility of non-drivers in communities, as “the [transportation] needs of older citizens are predictable, so accommodating them is possible” (Freund, 2004). Nevertheless, the wider implications of this potential challenge need to be placed against the backdrop that “mobility is critical to well-being” (Coughlin & Lacombe, 1997).

At a time when 85 percent of persons over the age of 15 years (Office of Highway Policy Information (OHPI), 2003) hold a driver’s license, and each person in 2001 traveled 40 miles per day (of which 35 miles were in a personal vehicle) (U.S Department of Transportation, 2003), mobility has reached unprecedented levels. This is coupled with seniors experiencing “longer, happier, fuller lives than their counterparts today and certainly than the elderly of just a few decades ago” (Rosenbloom, 2004). If the ability to drive (i.e., mobility) is synonymous with the enjoyment of life, Evans (2001), using 1995 Nationwide Personal Travel Survey (NPTS) data, it was found that there was “a substantial difference in trip making associated with driving that increases with age. This difference is most pronounced and most critical among the 75+ population. While 75 percent of 75+ drivers went out at least once on their trip day, just 44 percent of non-drivers age 75 and older went out.” A similar result was found by Straight (1997) in her study of travel behavior and preferences of drivers and non-drivers 75 years and older, where she concluded that the “level of mobility is strongly related to whether or not one drives.”

Rosenbloom (2004), while reflecting on the potential rosy outlook, goes on to state that “there is no evidence that older people’s desire to travel will decline at the same rate as their ability to drive or to find other options. Many older people may ultimately find themselves cut off from the very aspects of life that made their early retirement years so much better than those of older people only a few decades ago.” Along with the inability to drive and its impact on mobility, “declining health may well result in reduced activity regardless of the ability to drive” (Marottoli et al. 2000). Thus, it can be argued that there are at least two generalized mobility challenges faced by the elderly: the means of mobility, e.g., personal transportation; and the physical capacity to be mobile, influenced by the physical/health status of the individual.

Being able to operate an automobile has become synonymous (and, in many cases, a necessary requirement) to experience enhanced levels of livability and consumption. Foley et al. (2002) describe the operation of a motor car as a “pervasive task of independence.” The intimate relationship between man and the auto has resulted in a situation where, “for most Americans driving is considered essential to the well-being and essential to maintain a good quality of life” (Adler et al., 1999). This dependence on driving has created a situation where giving it up may be experienced as the first step towards a downward spiral of dependency (Horowitz et al., 2002). This state of dependency becomes critical when no family or friend is available nearby to assist the individual, which may lead to isolation, eating disorders, institutionalization, and premature death (McSwain, as quoted in Stanfield [1996]). Because of dependency on a lifestyle that has revolved around the capacity to drive an auto, any changes brought about by transitions in personal mobility will have far-reaching consequences, impacting not only on the individuals involved but their immediate families and society as well.

The uniqueness of the U.S. mobility environment has given rise to the above situation as, “in many areas of the U.S., there is no adequate public transportation, and many people must drive if they are to function in their community” (Freedman & Freedman, 1996). Indeed, “recent and contemporary urban zoning practices and public transportation policies have catapulted the private car into its role as the preeminent means of individual transportation” (Yassuda et al., 1997). This has resulted in negative and yet unwarranted perceptions of public transportation to be held by many people. Studies have related how the elderly have viewed public transportation in the U.S. as inconvenient, unpleasant, and even dangerous if it requires waiting at secluded bus stops or crossing busy intersections (Messinger-Rapport & Rader, 2000). Noting these negative perceptions of public transportation, the elderly may feel that after driving for many years, “they deserve better” (Shope, 2003).

The urgency of the need for the prediction of impairments that may influence driving cessation must not be trivialized, as “the longer an individual drives, the more accustomed they become towards driving and the less likely they are to cease from driving even after diagnosis [of a condition that affects driving ability] and the greater risk they become to other road users,” as stated to by Adler et al., (1999). Faculties subject to age-related impairment include gross motor skills, cognitive ability, vision and hearing. In addition, the impacts of this growing problem are more pervasive due to the fact that “personal and public safety may be threatened because of the high prevalence of dementia in the elderly and its effects on driving skills” (Berger & Rosner, 2000).

A “mix of conditions may lead to driving cessation,” according to Campbell et al. (1993). Changes in personal mobility may arise due to many different factors. Such changes may be sudden, such as injury resulting from a traffic or work related accident; gradual, such as a transition of socio-economic status from regular worker to retiree, cognitive, and physical impairments; or ongoing, such as chronic medical conditions such as diabetes. Correctly

predicting the onset of these changes may permit interventions that may manage the rate of change and, in turn, prolong an acquired level of mobility resulting in the maintenance of an active lifestyle, a scenario that becomes increasingly important with age.

This research effort, while exploratory in nature and modest in the context of all that should be learned about the mobility needs of an aging population, will strive to provide greater insight into the impacts of vision testing and the implications to individuals and mobility providers.

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LITERATURE REVIEW

The objectives of the literature review are to present the concept of driving cessation as it relates to aging; assess visual predictors of driving cessation in the elderly population; identify other predictors of driving cessation (with the exception of anatomical) under the two broad categories of gradual/unplanned versus sudden/unplanned; present driving cessation issues arising from retirement migration and household composition; understand the elderly and their knowledge, ability, and actual use of transit; and highlight potential challenges that may be faced in the surveying the elderly.

This literature review is based on studies conducted in the U.S. from January 1990 to December 2004. Electronic databases including Ageline, PsycInfo, Medline, Pubmed and TRIS (of the Bureau of Transportation Statistics) related to aging/gerontology and transportation were searched. The key search strings were “driving cessation,” “cessation of driving,” and “seniors and transit.” Searching these databases resulted in more than 200 hits. Articles dealing with the predictors of traffic crashes or the symptoms evident in drivers after the cessation of driving have generally not been considered; a publication entitled “Age-Related Disabilities That May Impair Driving and Their Assessment” provides an exhaustive literature review by Janke (1994).

Demographics

It is clear from Figure 1 that the percentage of persons of the total U.S. population over 65 years of age will continue to grow. By the year 2030, the number of persons 65 years or older will increase more than 100 percent. If, in 2000, the percentage of persons aged 55 - 59 years who hold a driver’s license is near 100 percent (see Figure 2), many of these surviving persons will be further along into the elderly age cohort in 2030 (aged around 85 years). Along with this forecasted growth in the elderly age cohort (55+ years), “the percentage of older drivers will also increase, some of whom will suffer from dementia” (Adler et al., 1999).

Driving Cessation

Driving cessation can be (i) voluntary (i.e., without legal intervention)(Dellinger et al., 2001) or (ii) mandated (i.e., forced), stemming from the intervention by a third party such as a family member or court. Driving cessation differs from driving restriction; the latter is a process where individuals manage their impairment by driving at specific times of the day along familiar routes and/or avoiding left turns for example. In a study by Straight (1997) of drivers and non drivers over 75 years, it was found that 63 percent of drivers who still drive said they avoid traveling at night, 34 percent avoid driving in the rain, and 50 percent of drivers avoid driving during rush hour. According to Burkhardt et al. (1998), to minimize the

negative connotations surrounding the word “cessation” or “quitting,” phrases such as “graduating from driving” may be more amenable, especially to the male psyche.

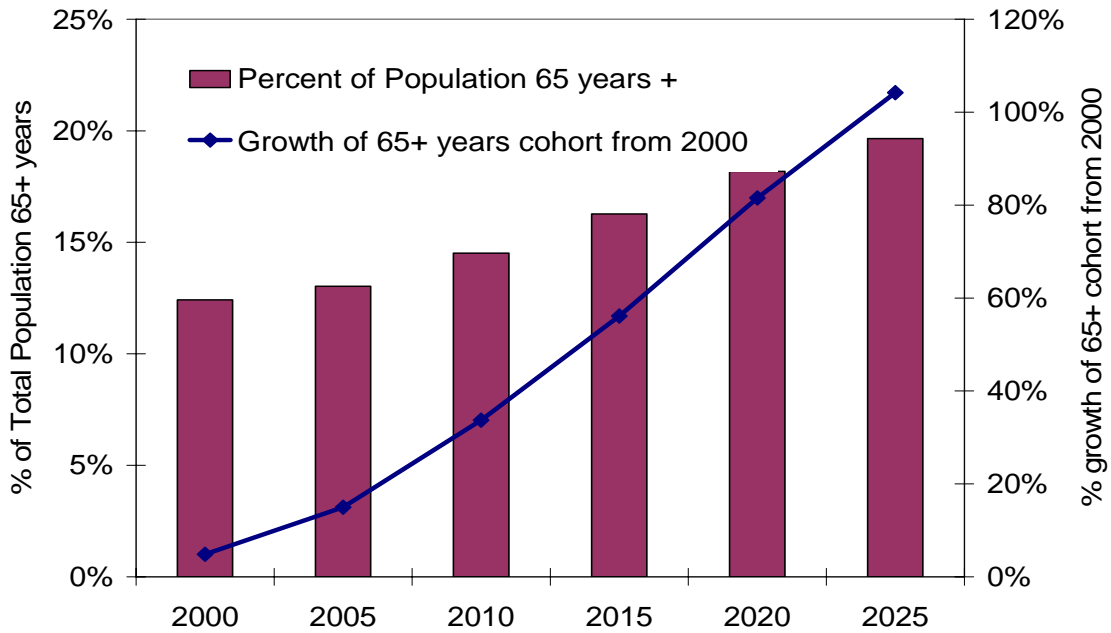


Figure 1 – Percentage of Persons 65 Years or More of Total Population (2000 – 2025) Source: U.S. Census Bureau (2005)

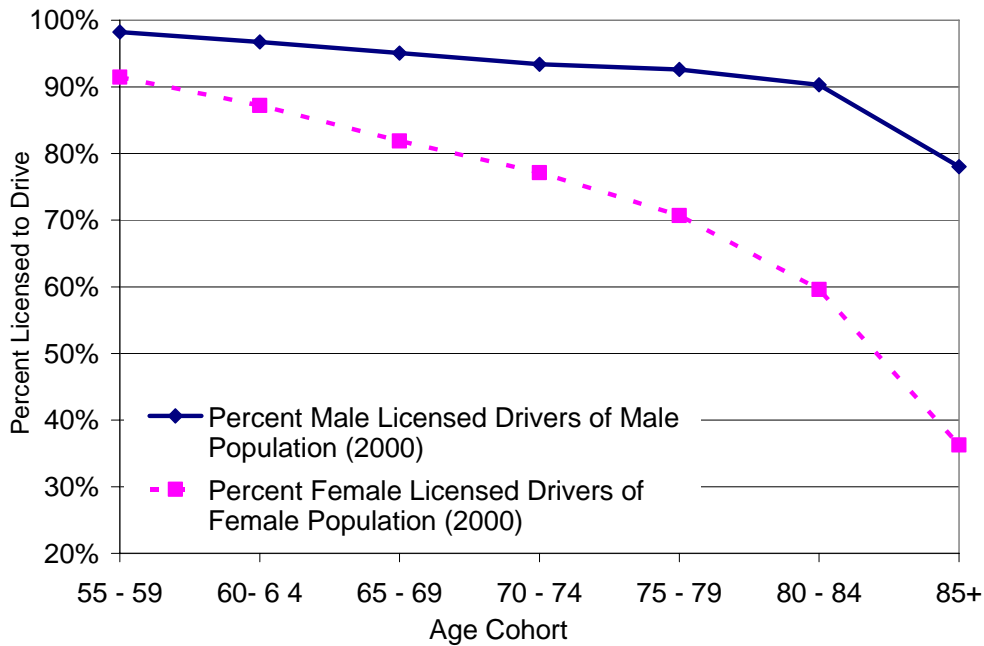


Figure 2 – Percentage of Seniors with Drivers License (Year 2000) Source: U.S. Census Bureau & OHPI/Federal Highways Administration

Kostyniuk & Shope (2003) and Cobb & Coughlin (2004) remark that “there is no precise age at which a driver becomes an older driver.” This fact is further emphasized by Coughlin (2001) when he states that the “chronological age is not a perfect indicator of who is an older driver.” However, through the examination of crash statistics, crash rates and mortality have been shown to increase significantly after the age of 55 years. According to Marottoli et al. (2000), “caution should be exercised in crafting legislation until acceptable levels of risk are identified in order to avoid over-regulating and unnecessarily preventing large numbers of people from driving, with potential substantial negative effects on their lifestyles managing the senior drivers.” Rosenbloom (2003) reported that “many countries and a few U.S. states are moving away from age-based testing to behavior-based testing.” Such a strategy has been argued to have merit; Rosenbloom, in the same article, states, “age-based testing is rarely useful or cost-effective.”

During a period of driving restriction, trip making can still be made “without searching for alternative travel modes” (Waldorf, 2001). This period provides a “window of opportunity” (Wang & Carr, 2004) for the elderly to consider future travel needs and modes that may be suitable to meet them. This period of opportunity, evidenced by restrictions in driving behavior, may have a downside if remedial actions are not taken in that “anticipated mobility consequences actively discourage some persons from reducing or ceasing driving” (Burkhardt, 1999). Thus, unsafe drivers continue to drive, posing a danger to themselves and others while ignoring alternative transportation possibilities that may be available. By considering alternative transportation possibilities during the period of driving restriction, the trauma of being forced to quickly consider alternative modes and trip-making behavior when driving has ceased altogether is reduced.

Predictors of Driving Cessation

According to Owsley (1997), key predictors or identifying factors of driving cessation may be multiple or severe functional impairment (e.g., cognitive) and visual and/or motor impairment. In the process of identifying visual traits as a predictor of driving cessation, a dichotomy is faced as, according to Sterns et al. (2003), on the one hand, “there is a need to enable the individual to drive as late in life as possible as long as they can do so safely” and also “there is a need to facilitate the individual to stop driving when it is no longer safe.” The importance of this challenge cannot be underestimated. A study by Yassuda et al. (1997) found that focus group participants did not consider driving cessation to be transportation option and, in fact, would do everything within their power to continue driving regardless of their health status. The reality of anticipating driving cessation is a valid concern, as evidenced in a study by Kostyniuk et al. (2000), where it was concluded that “the degree to which drivers can report anticipating problems in their future driving identifies where people are in the driving reduction/cessation process.” Furthermore, “those who anticipate driving problems seem closer to the point of driving cessation.”

The Process of Driving Cessation

It is helpful to understand the concept of driving cessation from an aging perspective. Figure 3 presents the process of driving cessation and the ceasing of trips made as a driver and the possibility of future travel being made as a passenger using private or public transportation. It is accepted in the majority of cases that driving cessation is a process and has been appropriately described as a “cessation continuum” by Dellinger et al. (2001). Here, the cessation process occurs in stages as a gradual progression of self-imposed restrictions on driving that culminate in cessation. Gilley et al., (1991) noted, “driving cessation is not an all or nothing phenomenon but the eventual end point of a gradual reduction in driving activity.” A similar definition was also expressed by Horowitz et al (2002).

In Figure 3, assuming a starting point at age 55, there is relatively little change in the miles driven per year by the individual in the early years. This period of continued competent driving ability creates a “window of opportunity” (Wang & Carr, 2004). According to Wang & Carr, during this phase there is the possibility for medical interventions to be applied (e.g., appropriate pharmacotherapy for neurological disease, treatment of reversible ophthalmological diseases, physical therapy for fragility or muscle weakness, occupational therapy for functional deficits) that may help older adults maintain driving skills and confidence in their driving performance. Other factors affecting the length of this window of opportunity are the patient, the family and the medical care team of patient; difficulties of the individual adhering to advice regarding driving cessation; and failure of professionals to inform the individual of impairments impacting on their driving ability (Friedland, 1997).

The challenge of making the decision to cease driving at the right time is alluded to by Adler & Kuskowski (2003), where they noted, in the case of individuals suffering from dementia, that the progression in the level of competence in making correct decisions also declines. Again, using cognitive decline as an example, Hebert et al. (2002) also noted that there is no specific timeframe within the course of cognitive decline that patients consistently exhibit difficulties with driving, making it difficult for physicians or other professionals to make appropriate “global” recommendations regarding driving cessation. Thus, if the decision to cease from driving is a personal decision by an individual suffering from an impairment (which directly impacts their driving ability), an appropriate decision may not be made, pointing further down the driving cessation continuum curve in Figure 3.

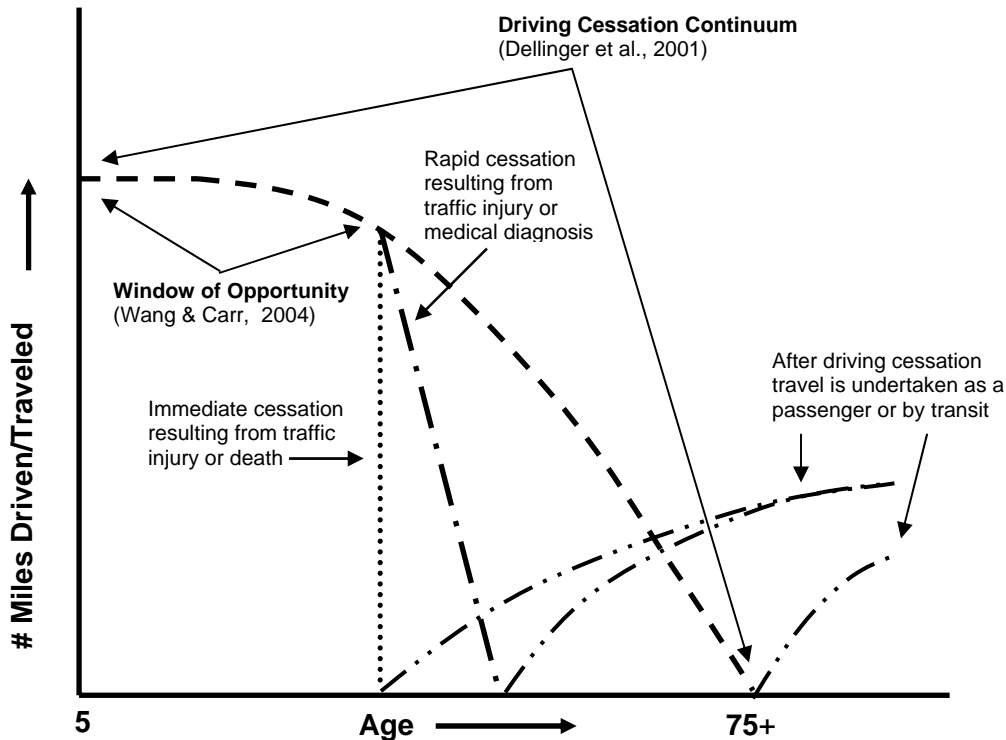


Figure 3 – The Process of Driving Cessation

Effects of Driving Cessation

Several researchers have explored the effects of driving cessation. Among the observations reported in the literature are “decreased out-of-home activity levels adversely affecting an older person’s activity level” (Marottoli et al., 2000); “very large drops in travel far beyond what would be expected in normal aging” (Rosenbloom, 2001); and “reductions in the places visited and the activities in which they engage” (Rosenbloom, 2001). Evans (2001), using NPTS data, confirmed that “the non-driving population over the age of 75 are among the least mobile, and among those most at risk for the social isolation and inadequate service availability as a result of reduced mobility.” One of the largest challenge facing researchers is discerning the extent of reduced activity as a result of mobility limitations from the reductions that are caused by the same factors that resulted in the mobility limitations.

Driving Cessation - Visual Factors/ Diseases

“Vision acuity is the most ubiquitous visual-screening test used by licensing agencies to determine driving fitness; however, research does not support the conclusion that acuity testing can identify high-risk drivers effectively” (Owsley, 2004). Rosenbloom (2003) also identifies the inconclusive nature of the relationship between vision and driving safety: “even poor vision - the

most common condition older drivers are screened for - has little relationship to crashes among the elderly.” Thus, the significance of the mandated vision testing of elderly drivers may have a tenuous link to driving and crash propensity.

Problems with vision represent one of the leading chronic conditions associated with reduction in or cessation of driving, according to Satariano et al. (2004). As the individual ages, older drivers may change their driving habits, a type of compensatory process along the driving cessation continuum (see Figure 3) in response to age-related visual declines (Schieber et al., 1992). Older adults are at risk for a variety of decreased functioning within the eye. With age, the eye changes in several ways, leading to several effects: the lens loses elasticity, decreasing the ability to focus, and it yellows, affecting light sensitivity and acuity (Satariano et al., 2004).

In a study of older women and driving cessation, Bauer & Rotunda (2003) found that, despite Parkinson’s disease and recent surgery, it was decreasing eyesight from macular degeneration that precipitated driving cessation. Satariano et al. (2004) also found that problems with vision were highly associated with modified or avoidant driving behavior in older adults (84 percent in women 75 years and older, and 75 percent in men 75 years and older). Campbell et al. (1993), in an earlier study, found that vision-related problems, such as retinal hemorrhaging, macular degeneration, etc., were significantly more common among former drivers. Such a finding was also corroborated by Horowitz et al. (2002) and Stewart et al. (1993), where it was found that vision impairment/status was a significant independent factor of driving status. Twenty percent of study participants in a research study by Persson (1993) cited vision related factors precipitating cessation. In this study, three of the four highest illnesses indicated by participants that interfered with driving were vision-related (cataracts, macular degeneration, glaucoma).

Mathematical relationships developed by Horowitz et al. (2002) established that, for every unit increase in vision loss severity, there was a 13 percent decreased likelihood of driving. Dellinger et al. (2001) found that, among the medical problems given for driving cessation, vision-related problems were the most common. Additional studies have found that indicators of vision problems are evidenced when individuals become “surprised” by other vehicles when merging and/or have noticed that other vehicles appeared unexpectedly in their peripheral vision (Kline et al., 1992). Dellinger et al. (2001) and Marottoli et al. (1993) both go on to confirm that vision plays a key role in how often and how far people drive.

Finally, in a study by Forrest et al. (1997), it was found that poor vision was an independent factor associated with driving cessation. An extensive review of literature published between 1988 and 1994 relating vision and driving can be found in “Recent Developments in Vision, Aging and Driving: 1988 – 1994” by Frank Schieber of the University of South Dakota.

Driving Cessation - Other Factors

Other factors, with the exception of anatomical or cognitive, can be grouped into two categories: gradual/planned and sudden/unplanned. Gradual/planned factors can be classified as being “involved,” i.e., accepting that the impaired person is an adult who has the right to be included in decision affecting his or her life (Jett et al., 2002). Such a strategy is time-consuming, and its success is dependent on the level of impairment in the individual concerned. In the case of sudden/unplanned factors, they can be incident- or accident-based or classified as being imposed, i.e., imposed on the individual by other parties, as the individual is unwilling to make the change by himself or herself (Jett et al., 2002).

Gradual and Planned - Individual

Sixty percent of participants in a study by Campbell et al. (1993) indicated that they voluntarily ceased from driving. Though commendable, Campbell and colleagues went on to explain that such a response may indicate that the participant had a less severe disease than those participants in the study who identified a disease that precipitated driving cessation or the participants may have had a disease but, since the diagnosis of the disease, have been in a state of denial about its impact. Another factor influencing driving cessation is for the impaired driver to acknowledge the potential danger that they may become to a loved one, neighbor or family pet, if they continue to drive (Jett et al., 2002).

Gradual and Planned - Age

Increasing age increases the chances of driving cessation (Campbell et al., 1993, Stewart et al., 1993). In a study by Dellinger et al. (2001) of those who ceased driving within the previous five years, 2 percent stopped in their 60s, 18 percent in their 70s, 63 percent stopped in their 80s, and 17 percent in their 90s. Forrest et al. (1997) reported that, as well as driving less with increasing age, women participants also were more likely to use avoidance strategies, such as not using freeways. Horowitz et al. (2002) estimated a 5 percent reduction in the number of study participants who drove with every year of increased age. Though aging is an accepted predictor in driving cessation, Owsley et al. (1998) pointed out the inappropriateness of guidelines, which determine the appropriateness of driving for older adults based on age alone.

Gradual and Planned - Gender

Driving cessation is predominately among elderly women (Freund & Szinovacz, 2002). A study by Campbell et al. (1993) also found that women were twice as likely to report having stopped driving than were men. A similar finding also was reached in a study by Stewart et al. (1993). Approximately two-thirds of the participants in a study by Dellinger et al. (2001) who had stopped driving within the previous five years were female, though gender differences (with respect to driving cessation) did not reach statistical significance. In another study by Foley et al. (2002), women participants were three times more likely to cease from driving when compared to male participants.

Gradual and Planned - Family involvement

One reason given by women participants that had ceased from driving in a study conducted by Dellinger et al. (2001) was that “someone else could drive them.” Yassuda et al. (1997) also found that focus group participants preferred other people to make the decision to cease from driving for them. Nevertheless, Dellinger et al. (2001) noted that, for respondents who had ceased from driving, a subjective assessment of the driver’s own driving ability was the primary factor in driving cessation, not advice from family or friends. A participant in Bauer & Rottunda’s study (2003) indicated that they did not want involvement of their children in deciding when they should stop driving. Indeed, the majority of participants in Bauer & Rottunda’s study decided for themselves. A similar finding was found in studies by Persson (1993) and Ralston et al. (2001). Campbell et al. (1993) found that participants did not include family as an influencing factor with respect to driving cessation; only the affected individual or legal requirement were involved. Despite the preceding, Hebert et al. (2002) noted that, with family/caregivers, there may be difficulty in objectively evaluating driving abilities of the affected loved one, and this, in turn, may prolong the period of driving cessation as they are unlikely to limit or stop their spouse/significant other from driving based solely on diagnosis.

Gradual and Planned – Co-Piloting

The definition of a co-pilot is “somebody available in the car who can directly instruct and supervise” (Jett et al., 2002). In a study by Foley et al. (2000), 10 percent of 59 participants diagnosed with dementia had not ceased from driving at the time of the study. These persons always drove with someone else present in the vehicle as a co-pilot, who, in most cases, was the spouse of the driver. Research by Freund & Szinovacz (2002) suggests that the lack of an alternative driver in the home kept cognitively-impaired women on the road, especially where a spouse who may have been the primary driver had been outlived. Co-piloting as a strategy may work for a limited time but, in situations where a decision is required quickly, driver response may be insufficient. Thus, it becomes a strategy that is not recommended in the process of driving cessation (Hartford Financial Services Group, 2000).

Gradual and Planned - Number and Type of Medications taken

Some medications can affect driving skills, which, in turn, will influence driving cessation. Medications that may impair driving skills include antidepressants, hypnotics, antihistamines, glaucoma agents, and muscle relaxants (Carr, 2000). However, in a study by Stewart et al. (1993), it was found that specific drug ingredients or the total number of drugs used were not a significant risk factor for driving cessation, a surprising result to the study team. Yassuda et al. (1997) noted that the low frequency of the medication topic (i.e., a participant response from the survey instrument) may reflect the participant’s lack of knowledge of the effects of drugs on driving ability, denial that drugs had any negative effect on driving, or even the belief that taking medicine was a part of normal aging.

Sudden and Unplanned - Life Event

A life event may precipitate driving cessation (see Figure 3). Such an event may be in the form of a diagnosis of a disease or a personal loss, such as the loss of spouse/partner. In a study by Bauer & Rottunda (2003), such life events experienced by participants ranged from a heart attack to a fall. A traffic crash often is a precipitator of driving cessation, especially when the individual had been advised against driving while managing some form of impairment.

According to Dobbs et al. (2002), while life events may have a severe negative impact on driving ability (in the case of the diagnosis of dementia), this should not be the sole justification for the revocation of a driver's license, which, in turn, can bring about an immediate cessation of driving.

Sudden and Unplanned - Government Agencies

As already noted, gradual change in the process of driving cessation will allow managed interventions, where various parties may become involved in the decision for an individual to cease from driving. On the other hand, if such interventions by persons closest to the affected individual are not forthcoming, medical professionals and/or governmental agencies, i.e., state driver license agencies, have a "moral and legal obligation to care for the demented individual and to protect the safety of the public" (Berger & Rosner, 2000). Campbell et al. (1993) found that the potential of license revocation/cancellation if driving is not curtailed significantly increases the odds of driving cessation among elderly persons. The potential loss of insurance coverage (Carr, 2000) also may bring about a sudden loss of driving privileges for the affected individual leading to rapid or immediate cessation of driving. The revocation of the driver's license by a third party has the potential to have the opposite effect. Burkhardt et al. (1998) identified research that had concluded that older drivers might be more likely to resist driving cessation, as such drivers claimed that a third party (e.g., state driver licensing authority) had forced them to continue driving by taking away their license prematurely.

Reluctance to Cease from Driving after Medical Diagnosis

Continuing to drive despite diagnosis of any form of impairment that directly impacts driving capability (i.e., extending further along the curve in Figure 3) can be the result of several factors where the affected individual (Adler et al., 1999):

- experiences no problems while driving and therefore does not limit driving;
- experiences some problems while driving but does not understanding the gravity of how such problems can impact driving ability and therefore continues to drive;
- suffers from the lack of transportation alternatives;
- resides in a rural versus urban location;
- wants to maintaining their self worth/dignity;
- wants to minimize inconvenience to themselves and immediate family, i.e., the individual is the sole driver in household;

- adopts a coping strategy where individuals with dementia may not have the cognitive skills required to adapt to the changes in lifestyle brought about by driving cessation (Hunt, 2003); and,
- is a male - men tend to cease from driving at a later stage of their lives; older males have been socialized to be the primary driver and generally have more years of driving experience (Bauer & Rottunda 2003).

A number of studies mentioned throughout this literature review have shown that the decision to cease driving should be a decision that involves the individual concerned, those closest to that individual, and professionals. The professional may be the family physician, occupational therapist, or social worker. The involvement of the professional is vitally important, as the patient and the immediate family may not be able to objectively evaluate the driving ability of the impaired patient (Adler et al., 1999).

Retirement Migration and Driving Cessation

There are two types of retiree migrants: “dependency migrants,” i.e., those persons relocating due to deterioration of their health or financial resources, and “amenity migrants,” i.e., persons relocating to attain a better lifestyle. The majority of retiree migrants to Sunbelt states such as Florida are those in the latter category. Earlier work by Longino et al. (1991) identified a three-stage retiree migratory process, as shown in Figure 4. The first is amenity migration, where affluent and healthy retirees migrate to enhance their lifestyles. The second is where seniors migrate to be closer to persons who can provide help as and when required. Such retirees who make this type of move often have suffered from the loss of spouse or are chronically ill. The third stage is the move from exclusive care by kin to institutional care. This last stage can be undertaken by retirees who chose to “age in place,” migrants who returned to their pre-retirement locations, or those who went directly from their “amenity” retirement locations to institutional care.

Longino (1995), in his exhaustive analysis of U.S. retiree migration, trends notes 10 critical factors (based on a *Where to Retire* magazine subscriber survey) that retirees consider when migrating: 1) low crime rate; 2) good hospital nearby; 3) low overall cost of living; 4) mild climate; 5) low overall taxes; 6) low housing costs; 7) friendly neighbors; 8) major city nearby; 9) no state income tax, and 10) active social/cultural environment. It is apparent that transportation was not explicitly considered as a factor (possibly taken for granted by the retiree). On the other hand, the lack of an explicit mention of a transportation-related factor was not the case in a study conducted by Haas & Serow (1993), where it was found that problems associated with urbanization such as congestion were a “push” factor precipitating senior interstate migration. Nevertheless, it is evident that, for the majority of factors mentioned by seniors precipitating migration, accessibility to personal transportation enables the benefits sought from such migration to be realized.

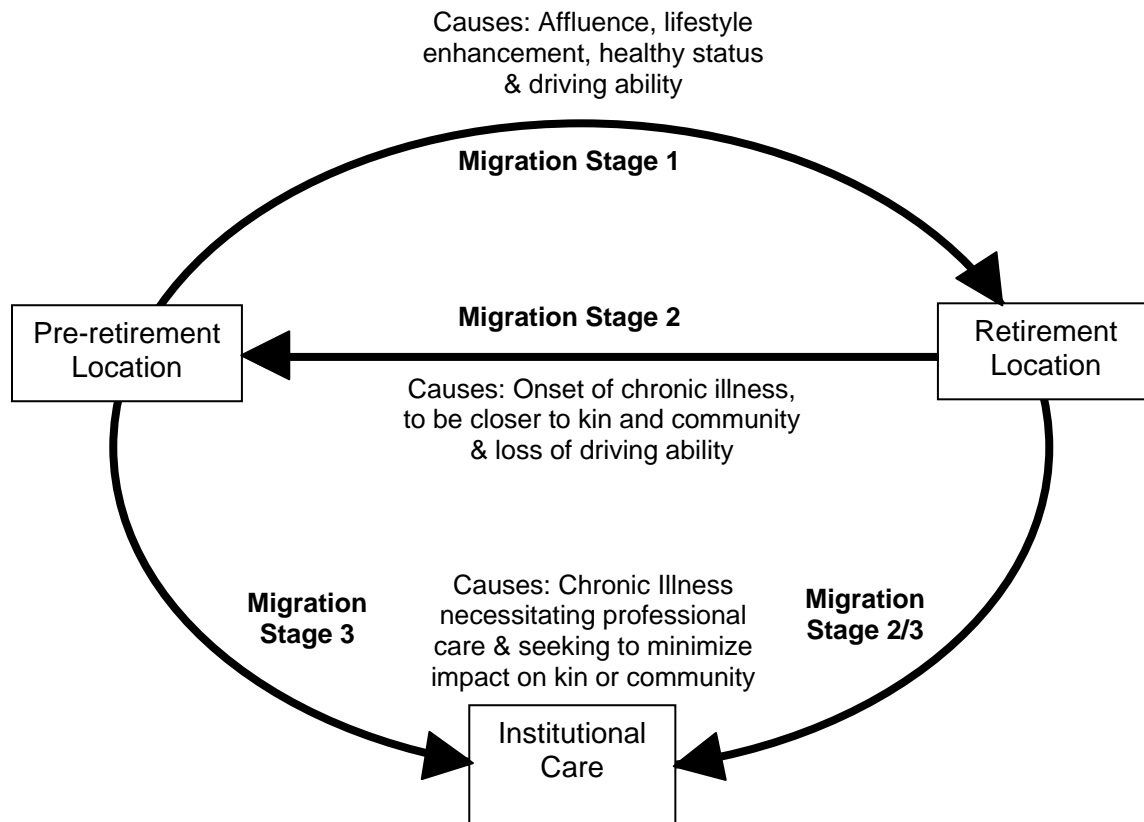


Figure 4 – The Retirement Migratory Cycle

As discussed earlier, the relatively increased affluence of seniors today, as evidenced by increased levels of mobility, has resulted in this group becoming immobile in another sense, “where they have shown an increasing disinclination to move after retirement” (Rosenbloom, 1993). In such cases, seniors age in place in their pre-retirement locales. Of those who do change locations to take advantage of transportation opportunities, Kostyniuk et al. (2000) found that, of the 60 seniors who had ceased from driving, only 1.2 percent indicated that they had moved to a place with better transportation and another 1.6 percent moved to a senior community that provided transportation services. It becomes evident that, in the migratory model put forward by Longino et al. (1991), availability or lack of personal transportation plays an integral role in the first and second retiree migratory moves.

Mobility and Retirement Location

Earlier in this literature review, it was noted that family involvement can play a role in determining the driving cessation process. When driving does cease, “moving to a location or setting where driving is less essential for meeting the basic necessities of life is one way to

address mobility problems” (Kostyniuk & Shope, 2003). In such a situation, proximity to family or friends may facilitate personal transportation needs. In a study by Longino et al. (2002), a major factor for seniors who chose to age in place was proximity to family and friends. In a similar study by Schiamberg & McKinney (2003), proximity to family was rated as the most important factor by 80 percent of participants who intended to age in place. Longino et al. (2002) also found that when asked about their most important factors in selecting Florida as a retiree destination, a significant percentage of survey respondents indicated proximity to friends (39%), proximity to religious or ethnic group (34%), and other relatives (27%) as most important.

Coughlin (2001) notes “baby boomers” have pushed beyond their parents’ communities in pursuit of the American Dream, where their aging in place may present an even greater service challenge to our current idea of public transportation. Straight (1997) explored the potential of seniors moving to a more mobility-friendly neighborhood. Respondents were asked whether they would consider moving if their community had houses or apartments available near shopping; most non-drivers said they would not. According to analysis of the 2000 census data Frey (2003) conclude, that, with respect to persons above 55 years, “suburban residences are more likely than city residences and the suburban aging in place phenomenon should be evident.” In the analysis, it was determined that 70 percent of persons between 55 - 64 years lived in the suburbs of large metro areas, compared to 69 percent of persons 65 years and up. The suburbs often have been seen as a challenge to public transportation service providers and, unless truly viable and attractive transportation services are greatly expanded or invented, they may not meet the mobility needs of older adults who do not or who no longer drive but are situated in these suburban environments.

The lack of public transportation alternatives in potential retirement communities may stifle migration and income transfer potential of seniors who do not drive. Stanfield (1996), in an article on aging in America, notes that an individual who wanted to retire back to his native Culpepper (Virginia), later found out about the lack of public transportation in his home town, and subsequently decided against moving and continued his retirement in an assisted living facility in Takoma Park (Maryland). The importance of accessibility to transportation (especially for the transportation disadvantaged population similar to the senior mentioned earlier in this paragraph) cannot be underestimated. Longino & Bradley (2003) remind state strategic planners that “unplanned and uncontrolled housing development for retirees may attract new immigrants in the short term but render it impossible to deliver the quality of life that older migrants may be looking for.” The type of developments alluded to by Longino & Bradley (2003) and Stanfield (1996) and evident in the typical suburban environment, in many cases, have developed without an adequate public transportation infrastructure, which, in turn, may limit the quality of life attractiveness as permanent and stable retirement locations for the oldest-old as their personal transportation needs may be not met.

Household Composition and Driving Cessation

Persons living with a senior driver do have a role to play in the driving cessation process, despite the fact that some drivers who cease to drive have indicated that they made the decision themselves without outside influence. Household composition is, therefore, a factor in the driving cessation process. Kington et al. (1994), in a study of 2,429 respondents, found that “individuals who lived in households with more adults were less likely to drive.” The research team went on further to note that this situation may have arisen because, where there are other adults in the household who are able to drive, those who can no longer drive choose to live or remain in such households. In a study of Public Use Microdata Sample (PUMS) from the 1980 Census of Population, Cutler & Coward (1992) were able to determine that the majority of elderly persons (77%) live in households where personal transportation was available. Nevertheless, Cutler & Raymond were not able to determine how many of these persons actually were drivers or passengers (as the census data collected did not permit this).

In a study by Taylor and Tripodes (2001), it was found that “the composition of the household in which an elder lives also determines the transportation resources available . . . as the presence of a licensed driver in the home was the most important predictor of perceived mobility following driving loss.” Waldorf’s study (2001) came to a similar conclusion where it was found that the “presence of an additional driver in the household is the single most important factor influencing whether older people intend to use alternative transportation modes.”

Seniors and Transit

Rosenbloom (1993) notes that “the elderly have financial, emotional or physical disabilities that prevent them from using public transit and those that could use transit have inadequate transit service and need more.” The suburban lifestyle that many seniors have followed for many years has, in the majority of cases, not involved use of public transportation. Thus, “the operational limitation of special services cannot replace the mobility and freedom the car gives all travelers” (Rosenbloom, 1993). Yet, it has been argued that public transportation, when compared to paratransit services, affords greater opportunity for seniors to meet their mobility needs (when access to private transportation is limited). Researchers commenting on the inflexibility of paratransit services in meeting senior mobility needs have noted that “paratransit will take you certain places while public transit opens the world to you” (McSwain, as quoted in Stanfield, 1996).

Rosenbloom (2003), a nationally-recognized expert of elderly mobility, also notes that “the general public have too long assumed that there are sufficient community resources like paratransit services, taxis and public transit to meet the needs of older people forced to give up driving. But most communities are far from meeting the transportation needs of the elderly today and are less likely to do so in the next three decades when the population of older people doubles.” As the numbers of seniors grow, so, too, will their transportation requirements,

shifting from personally operated vehicles to being a passenger in private vehicle and ultimately using public transportation. This progression is supported in research by Straight (1997), where it was indicated that the mode of travel typically changes as a person ages. Achieving the potential of greater public transportation use by non-driving seniors, Burkhardt et al. (1998) suggested the development of “innovative alternative transportation programs that enable older persons to get around without feeling as dependent or beholden to others as they might otherwise feel if they had to constantly ask someone else for a ride.”

The lack of enthusiasm in using public transportation by seniors is related to the amount of control they have over the means of their transportation/travel experience. Wallace and Franc (1999), quoting research by Gonda, noted that, “as control over the transportation mode is increased (from scheduled public transportation to on-call private modes, to acquiring rides from acquaintances and family, to driving one’s own automobile), measures of life satisfaction increase.” They go on to state that “public transit, paratransit and taxis or other private transportation modes do not fully provide the mobility [older women] expected with the automobile, and therefore many elders do not choose to pursue public transportation as a viable alternative to automobile travel.”

Knowledge of Transit

Kostyniuk et al. (2000) studied senior drivers who anticipated driving cessation. Thirty percent indicated a need to learn about public transportation and how it could meet their needs after cessation of driving. This significant percentage may indicate that seniors either had no prior knowledge of public transportation in their area or wanted specific information to make informed decisions as to how transit may meet their future travel needs. Nevertheless, thinking about using public transportation does not guarantee that the senior will use it.

Coughlin & Lacombe (1997) also note that “people who have relied on their automobile are probably not aware of all the transit options available and may be unwilling to try transit.” Marketing and community outreach programs may help resolve this impasse. Burkhardt et al. (1998), in their study of driving cessation in women, noted “that the presence of viable alternative transportation options did not appear to make the transition from driving to not driving any easier for these women.” Burkhardt, in a later study (1999), also noted that “because so many people rely on their cars, they are unfamiliar with alternative forms of transportation and they may be reluctant or unable to learn them at an advanced age.” Ceasing driving typically results in a substantially increased travel time (when no longer driving) due to waiting time for the service to arrive, whether provided by friends, family, or transportation service for both the trip out and return trip; walking to the destination or bus stop; and having to fit in with someone else’s schedule.

Ability to Use Transit

Stutts et al. (2001) found that, of former drivers who did not use public transportation, the reasons given were do not need to use, 29 percent; service not available, 34 percent; schedule and routing inconvenience, 15 percent; and physical limitations, 20 percent. A National Research Council study quoted in Rosenbloom (1993) indicated that the low incidence of seniors using transit was not simply due to a lack of transit service but the “inherent inability of traditional services to serve the far-flung travel patterns of the largely suburban elderly population.” The problems that prevent someone from becoming or remaining a driver can reduce the desire for travel or the financial or physical ability to use the community services that require travel.

Waldorf’s study (2001) found that seniors were more willing to explore and use alternative transportation modes for very essential trips (i.e., life-maintaining) but were less likely or willing to do so for a trip that can be cancelled without posing an immediate danger to life (i.e., life enriching trips). In Waldorf’s study, it was found that taking the bus emerged as the most important alternative transportation mode for seniors who intended to visit family and friends, attend religious events, attend social events, and visit the doctor. Walking was the preferred mode for grocery shopping and prescriptions. Waldorf explains this scenario as being the result of grocery stores (which in the U.S. also may house a pharmacy) being situated close to the seniors’ place of residence and thus within walking distance. Coughlin & Lacombe (1997) also note, “for those seniors who are able who live in communities where there are nearby shops and services, walking is the number one transportation alternative.”

The ideal scenario may be based on being a healthy individual; Wallace and Franc (1999) note that “two blocks of foot travel may be an unreasonable health burden for many less ambulatory elders.” Straight’s study (1997) of senior drivers and non-drivers found that 49 percent of non-drivers indicated that they could not walk to a bus stop, and 54 percent could not walk to a grocery store. Kington et al. (2003) noted that the presence of arthritis was associated with a higher probability of continuing driving. It was surmised that other modes of transportation, such as public transportation, may have been so unsuited to accommodating those with functional limitations that persons in this situation continue driving as the least difficult means of reliable transportation.

One may be able to physically use transit but be limited in doing so by the limited availability of sidewalks due to zoning regulations (a fact pertinent to Florida). As Coughlin (2001) noted, “in many new suburban developments, sidewalks have been ‘zoned out’ in an attempt to maintain as much of a pastoral surrounding as possible. Unfortunately, while such measures may improve selected aesthetic values, they may significantly limit lifelong mobility and independence.” As Stanfield (1996) notes, “zoning laws affect both the proximity of housing to shops and services, such as a bus stop, as well as the size, type and style of the housing itself.

This latter aspect of zoning may be the more crucial in determining whether baby boomers will be able to age in place.”

Potentially influencing the acceptance of public transit options is the industry strategy to steer demand to the most cost-effective alternative mode. “Demand diversion is an attempt to curtail older and disabled passenger demand for paratransit services by directing these passengers to use fixed-route bus and rail services” (Cobb & Coughlin, 2004). Such a strategy is likely to founder with respect to low frequency transit routes, as Burkhardt (1999) notes that “it requires a great deal of planning for an older person to get to and from a destination without personally driving.” Non-familiarity with detailed travel planning (to be expected of former drivers having immediate access to a car) acts as a deterrent in using public transportation. Burkhardt (1999) also found that, to reduce the required travel planning to a more manageable level while maintaining independence, minicabs were the preferred mode of travel as the minicab mode, allowing individuals to control when and how they arrived.

Use of Transit

Straight (1997) indicated that nearly half of those who said they could not walk to a bus stop responded positively to one or more suggested design features that could make walking to a bus stop possible. The suggestions included a resting place along the way, a bus stop within five blocks of home, walking routes that are not along busy streets, and better sidewalks. In the same study, Straight discovered that 86 percent of non-drivers said they did not use public transportation. When asked why not, one-third of these said that they prefer to rely on family and friends, and about one-third said that public transportation was not available. Other reasons for non-use included the inconvenience of public transit and personal physical problems.

The Stutts et al. (2001) study of senior women who had ceased or restricted their driving found that more than 66 percent of drivers (both former and current) had never used public transportation; in the case of former drivers only, this amounted to 9 percent. In a study by Taylor & Tripodes (2001), it was found that less than 1 percent of study participants reported using any alternative mode, and no increase was observed in the number of study participants walking, using public transit, taxi, or van service following revocation of driving license. In fact, the majority of study participants depended on the private car as their primary means of transportation to all destinations initially, with themselves as the driver and subsequently as a passenger. The low patronage of public transportation by seniors according to Coughlin (2001) was “due to travel behaviors developed as younger adults as well as the spatial and service realities of today’s public transportation.” There is still potential of public transportation use by the oldest-old, as Waldorf (2001) found that the “intention to use alternative transportation modes increases with age.” In addition to age, marital status and gender also were strong predictors of intended use of alternative transportation modes, with single women (some widowed) more prone to use alternative transportation.

“In automobile oriented societies, travel alternatives such as walking, public transit etc., are rarely utilized by those having the opportunity to be a car passenger” (Waldorf, 2001). Participants in Waldorf’s study, when faced with the prospect of driving cessation, overwhelmingly (between 66 to 70 percent according to trip type) intended to ask others for a ride by car. Burkhardt (1999) found that of the few survey participants who used public transportation and were willing to go out during the evening, it remained difficult because buses often stop running before programs were finished. Kostyniuk & Shope (2003) found that a negligible amount of current and former drivers relied primarily or secondarily on public transit.

Surveying Senior Travel Behavior

Undertaking a research project where the human subject being studied is elderly requires an innovative and considerate approach in order to maximize the potential of quality data being obtained. With respect to the current study of driving cessation and subsequent public transportation use, a number challenges may be faced, some of which are described below.

Self-Reporting

The literature review revealed a variety of survey limitations in studies of driving cessation, including self-reported data leading to inconsistent responses (possibly due to misunderstood questions by the respondent) and recall challenges by the participant (the further into the past, the less likely one is to remember); responses from both scenarios may not have been validated by the research team (Adler & Kuskowski, 2003; Campbell et al., 1993; Dellinger et al., 2001; Forrest et al., 1997; Kline et al., 1992; Stewart et al., 1993).

Owsley (1997) notes another challenge of self-reporting is that measuring driving exposure by recalling how much one drives is difficult to measure. Owsley points out that driving exposure is not just how far a person drives but how long is spent driving and where, both of which can be problematic to determine from self-reported information. On the other hand, with respect to the accuracy of self-reporting, in a study by Persson (1993), due to the nature of driving being a fundamental factor in maintaining independence, study participants had no problem in recalling their driving experiences.

Homogeneity and Health Status of Participant

The homogeneity of the study sample with respect to gender and/or race and/or educational level also was another limiting factor identified in studies by Adler & Kuskowski, 2003; Adler et al., 1999; Bauer et al., 2003; Dellinger et al., 2001; Forrest et al., 1997. In other studies, the small sample size was seen as a limitation (Adler et al., 2000; Bauer & Rottunda, 2003; Persson, 1993; Ralston et al., 2001). The actual health and volunteer status of study participants were seen as limitations, where the survival cohort represented a healthier group when compared to general population (Campbell et al., 1993; Marottoli et al., 1993; Stewart et al., 1993; Forrest et al., 1997; Stewart et al., 1993).

Survey Design and Environmental Setting

In some studies, creating a sample from a larger sampling frame (possibly a longitudinal study) resulted in participants being studied who were already participating in other studies concurrently, increasing the potential of repeat measurements, which may introduce an element of bias as reported by Owsley et al. (1998). On the other hand, other studies of the cross-sectional type identified a limitation where a once-off questionnaire would not enable responses to be followed over time or such studies did not allow causal attributions to be determined (as would be the case in a longitudinal study) (Freund & Szinovacz, 2002; Ralston et al., 2001).

The environmental setting of some of the studies (rural versus urban/suburban setting) was a limitation. Studies by Marottoli et al. (1993) and Ralston et al. (2001) identified this limitation. Rural/urban setting also was closely related to the availability of alternative transportation, which resulted in the lack of transportation choices possibly biasing the results of driving cessation studies in favor of continuing to drive (Freund & Szinovacz, 2002).

Sensitivity

Innovative and considerate survey methods are necessary ingredients maximize the potential response from elderly respondents. This will be the case where questions relating directly or indirectly to health of the respondent are asked either person-to-person or over the phone. Wilkins et al. (1999), in a study of women who had ceased from driving, noted, “telephone interviewing alone was not successful in screening out women with medical problems that limited their ability to drive.” It was subsequently found that participants who had declined to answer health problems during the telephone survey were able to share such issues during the focus group sessions.

Instrument use

With respect to the instrument being used to collect data from respondents during the data collection phase, deficiencies can affect response calibration later. In a study by Straight (1997), it was noted that, despite the weighting procedures used, the mobility of the 75+ population still may be overestimated in the survey undertaken. One or more explanations for this overestimation were possible. The sampling frame consisted of households with telephones, but telephone coverage correlates with age and health status, two factors also related to mobility. Non-cooperation with telephone surveys also is higher among the oldest-old. Furthermore, the use of the omnibus survey method, with its lack of thematic structure and minimal call-back procedure, also can suppress response rate.

Forecasting

Forecasting future transportation needs of seniors from the Baby-Boom era may not be simple when assuming universal driving ability among both genders, as Burkhardt et al. (1998) caution. They concluded that,

when making projections of the number of future drivers, assumptions about driver licensing and driving among females are critical. Using the assumption that females will drive at the same rate as males in the future creates a huge difference from the projected numbers of future older drivers based on a continuation of current trends, especially within the highest age groups. In the age groups of 80 and above, men drivers now outnumber the women drivers by about 2 to 1. If one assumes that an equivalency in driver licensing will be reached (that is, no gender difference in the percentages of elders holding driver's licenses), the current situation will be exactly reversed, and the number of female drivers will be almost double that of male drivers in the oldest age brackets. This would have the impact of adding one-third more oldest drivers to the roads in the year 2040. A change of that magnitude would create a very significant change from other scenarios projected for the future.

Conclusions

This literature review brought together a variety of articles that address aspects of the driving cessation process, alternatives for mobility, and gathering information about this issue. As indicated in Figure 3, the decision to cease driving should be considered during the "window of opportunity," which is preferably before impairments manifest themselves as diagnosed diseases. The earlier the start of the transition process to complete driving cessation, the greater the number of options that can be considered to manage and maintain mobility after driving cessation.

The concept of driving cessation and the subsequent need to manage alternative transportation modes through appropriate action has to be balanced against a society where "personal independence" enhanced by being able to drive has developed into a measure of one's self worth. As Fonda et al. (2001) and Friedland (1997) noted, driving cessation has become a sentinel for the progression towards death, as it signifies the attainment of old age and its stigma of dependency and/or the constriction of access to necessary and recreational activities. This scenario is a very real one, as Coughlin (2001) points out that "the loss of the driver's license or the reliance on self-regulation for safe and responsive mobility has the potential to turn decades of work to achieve the American Dream into a sentence of virtual house arrest and isolation." Thus, for many seniors, not being able to drive is synonymous with lowering levels of family and/or community involvement, which subsequently may be perceived by the affected individual as a measure of their worth/value to society and therefore themselves.

Attempting to remedy the potential situation of limited transportation alternatives, Rosenbloom (1993) notes that, "even if transit systems had the funds to dramatically increase route coverage and service schedules, they would meet only some of the needs of some of the elderly population." Longino et al. (2003) noted that retirees who are most likely to relocate to another state are those who have the fewest moorings, (e.g., family members and friends in the area where they currently reside). Is the level of public transportation provision a factor attracting or

restricting a migratory move? The literature review did not identify any studies that had considered level of transportation as an explicit factor in migration patterns of seniors. Nevertheless, the importance of transportation availability is a fundamental factor in the social, health and economic status of retirees as they age.

Driving cessation is a process along which each individual operates within a unique space. As no two individuals are the same, this literature review has presented the concept of driving cessation and the potential challenges in applying an age-based testing regimen as a “one rule fits all paradigm.” “The decision to relinquish driving privileges is complex and not dependent solely on medical problems, but it may involve the availability of alternative transportation as well as self image issues of the individual (Campbell et al., 1993; Freund & Szinovacz, 2001).” Thus, the key to a greater understanding of this process is continued research and monitoring by all parties involved in enhancing senior livability in the 21st century.

PROPOSED PROJECT METHODOLOGY

Task 3 is designed to refine the actual data collection and analysis plan in light of the project goals, knowledge about legal and practical experience in collecting this type of information from the senior population, knowledge gaps in our understanding of older driver behavior, and possible data availability and processing methods. This section outlines the findings to date and the options and decisions ahead as this project moves to fruition. The original project scope identified a set of research questions (i.e., hypotheses) that would be among those guiding the objectives of the research effort. To the extent that the research can address some or all of these questions as well as other questions that come to light during the project, it offers knowledge and value to the transportation community.

Research Hypotheses

Among the kinds of questions that one would hope to answer through this research are:

- Has the fear of the vision exam contributed to voluntary relinquishing of licenses?
- To what extent is the mobility impact of losing a license related to household characteristics?
- How has travel changed as a result of losing driving privileges (mode, frequency, temporal distribution, trip purpose)?
- How long after losing a license did it take for new travel patterns to stabilize?
- How has the willingness or attitude toward transit travel been impacted by transit availability at the home and common trip destinations?
- How has the willingness or attitude toward transit been impacted by the prior knowledge/experience using transit?
- Has the vision condition that resulted in losing a license impacted the ability to use fixed route or paratransit?
- What transit service characteristics would make transit a viable alternative travel option?

As is evident from the breadth of material covered in the literature review, the complexity of senior travel decisions and behavior is compounded by the difficulty in gathering information about historic, current and hypothetical situations from a sensitive population. This is further compounded by the experimental nature of this effort. Thus, the actual methodology options are replete with trade-offs in deciding how best to proceed within the budget and schedule.

Methodological Framework

The foundation for the exploration of methodology options is based on the conceptual model of elderly travel behavior and decision-making. This conceptual model is outlined in the next few figures. These two figures define the two basic decisions about which this research could focus. The first, shown in Figure 5, explores the range of considerations that weigh into the decision to

cease driving. Of interest to the public transportation community is the importance of the presence of public transportation options in that decision and the subsequent impact on public transportation if the decision to cease from driving is made. Thus research directed to understanding these two considerations would provide value to the public transportation community. The passage of Florida statute subsection (5) of section 322.18 creates an opportunity to learn more about 1) the driving cessation process and the extent/pace of cessation in light of this new requirement, and it, 2) indirectly provides an opportunity to explore post cessation travel behavior. Each of these research opportunities is discussed below.

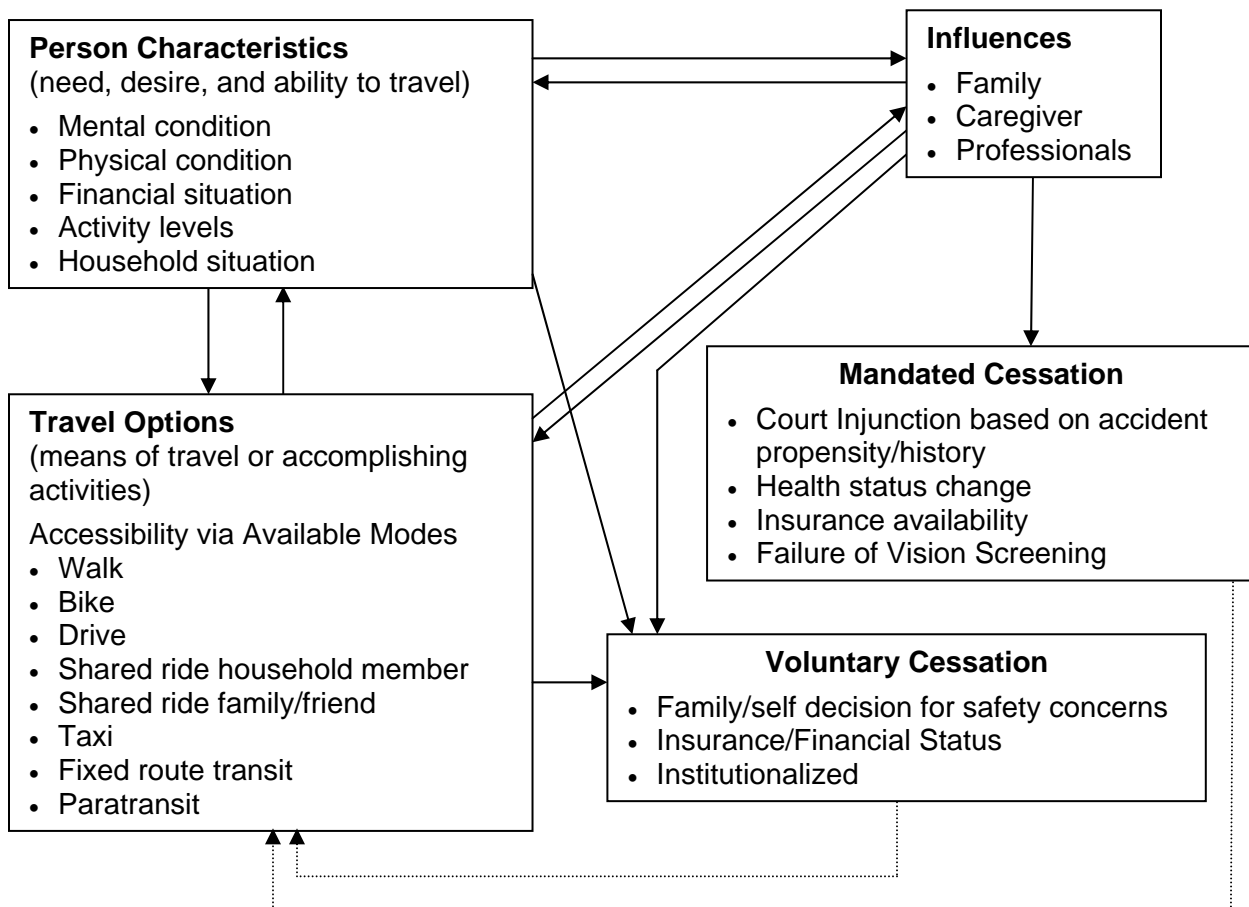


Figure 5 - The Decision on Ceasing to Drive (schematic of Older Traveler Travel Decision Making)

The Driving Cessation Process and the Pace of Cessation in Light of Vision Testing

The extent to which drivers leave active driving status will influence the overall market of persons who might have an enhanced interest in the use of public transit mobility options. One research opportunity is to explore the databases on licensed drivers and develop a richer understanding of the magnitude of the share of drivers who loose license status. CUTR has had several communications with HSMV regarding access to the database on licensed drivers. The quarterly progress report includes a copy of the formal request for access to the Mature Drivers License Database. This database, a static subset of the total driver database, is screened to only include drivers aged 55 years and older. This screening enables a smaller and more manageable data set. The smaller database still has approximately 5 million records, and each record has approximately 200 columns of data.

It is anticipated that this database will be available shortly (formal request was made on May 4, 2005 following previous email and verbal discussions). Various cross tabulations will be performed to gain insight into the size and nature of the older driver population in Florida, including quantifying the decline in the licensed population with age and developing some insight into the nature of non-renewal (e.g., deceased, lost due to accident, failure of vision screening). This analysis will be primarily descriptive and will result in a graphical and narrative report on the licensure status for older drivers.

As evidenced by Figure 5, the presence of various modal options is likely to be instrumental in voluntary driving cessation. Exploring the importance of alternatives would require gathering information from a sample of person who voluntarily gave up driving.

It is recognized that the licensure status is only one set of information that describes the mobility options for older drivers. Many drivers may reduce or quit driving while still maintaining a license until the next renewal, or maintain the license but give up a vehicle. Insurers have relatively recently begun to adjust risk factors and insurance rates for older drivers and there is some speculation that some older drivers may become priced out of driving if insurance rates become excessive.

The product of this part of the research will be a descriptive section of a technical report documenting a profile of older drivers based on the mature drivers license database for January 2005.

Concurrent Research

One of the delays in approving the CUTR request for access to the Mature Driver License Database was a desire on the part of HSMV to coordinate this research initiative with another initiative that is being carried out with the department cooperation's by Dr. Cynthia Owsley at the University of Alabama in Birmingham. Dr. Owsley is under contract to evaluate the impacts of the vision screening program. Her research team has been provided the full driver's license database and is currently completing its analysis, which was due in September 2005. This analysis is targeted to determine the social impacts of vision testing and includes collaboration with the Insurance institute, which is helping in developing a sample population of persons who are being surveyed. Contact with Dr. Owsley has been initiated to review her work to make sure the efforts are complementary and not duplicative. Her focus is not specific to public transportation and covers a limited time period.

Post Cessation Travel Behavior Decisions

The second major decision of research interest is post-driving cessation travel behavior. This decision logic is schematically portrayed in Figure 6. In this figure, the various characteristics that are known to influence travel decisions are portrayed, including socio-demographic traits of the traveler and service traits of the travel options. This schematic emphasizes the characteristics of public transit that may impact its viability as a post cessation alternative. Exploration of post cessation travel behavior would require data collection from a sample of persons who ceased driving. The research design for such data collections would involve the following three steps followed by an analysis and interpretation of each step.

1. Determine a sample of ceased drivers: The HSMV database can be a source of information on the population that formally gives up their licenses; however, as noted, it is not necessarily a sound measure of the population that ceases driving as there may be multiyear lag until this is reflected in the license database. In addition, the license database cannot be used to identify contact information for individuals. Alternative strategies would need to use other sources for identifying a sample of older persons and screen that for former drivers who have ceased from driving.

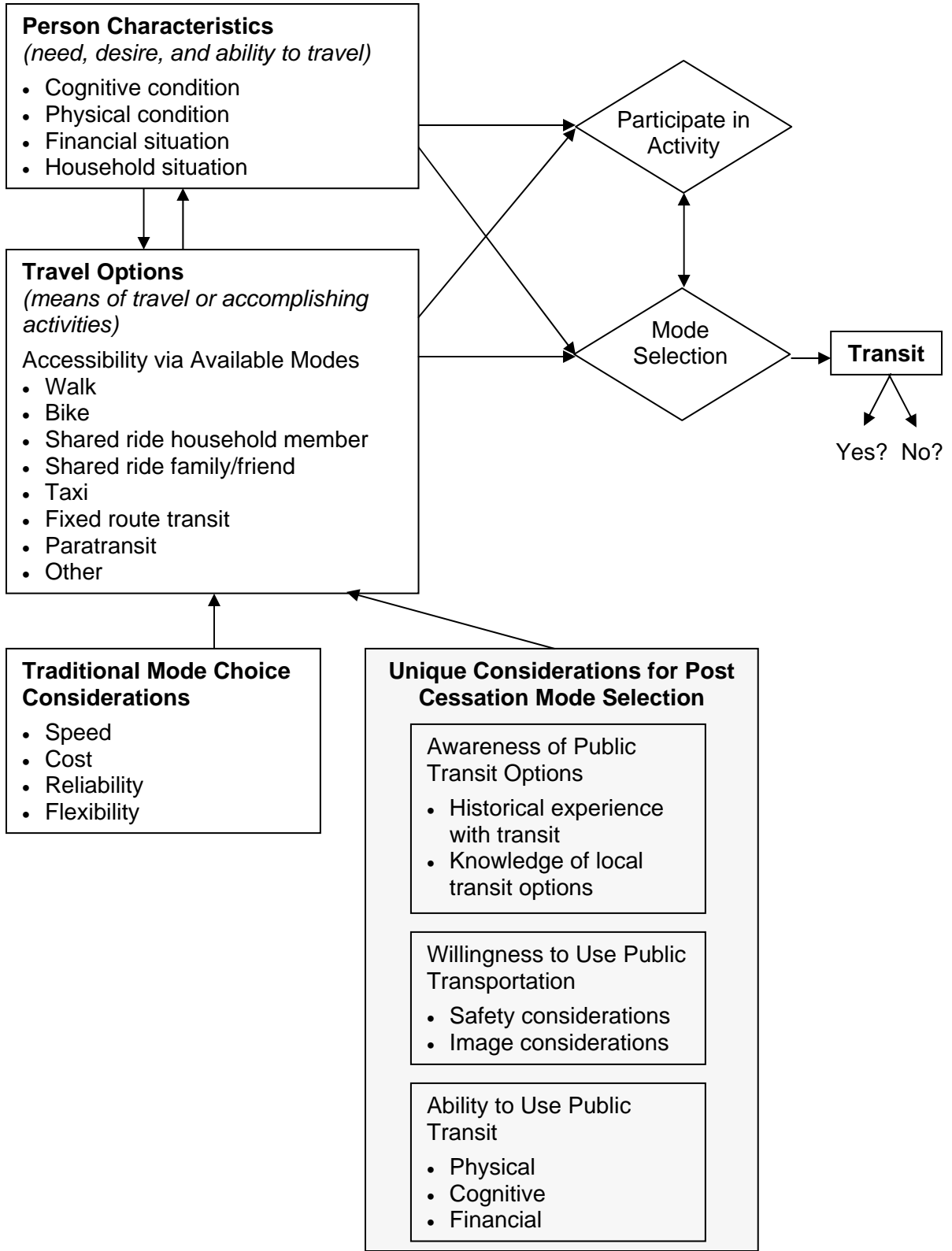


Figure 6 - The Decision on Using Public Transportation for Ceased Driver (schematic of Older Traveler Travel Decision Making)

2. Determine the representativeness of the sample relative to the target population: As in any data collection/sampling exercise, it is necessary to determine to the extent possible that the sample is representative of the total population. For sensitive populations, this is both particularly difficult and important. Any relevant characteristics of the population from age and medical condition to truthful answers and accurate recall are challenging for older populations especially when dealing with an issue as sensitive as mobility. Census data can be used to determine some aspects of representativeness such as age, income, etc.
3. Solicit information from the sample population through methodologies such as interview, survey, travel diary, or focus group: Each of these strategies has been used with varying success and for various particular focuses of understanding post cessation travel behavior. There are two particular areas that have been explored for this research: a) investigating perceptions and attitudes towards transit and transit use opportunities; and b) investigating actual travel behavior changes. Each is discussed below.

Investigating perceptions, attitudes and transit use opportunities

For the first focal area, one could solicit information from the sample via interview or focus groups about the specific unique characteristics of public transit that might influence post driving cessation use. These characteristics, as outlined in Figure 6, include the following:

- Awareness of Public Transit Options
 - Historical experience with transit
 - Knowledge of local transit options
- Willingness to Use Public Transportation
 - Safety considerations
 - Image considerations
- Ability to Use Public Transit
 - Physical
 - Cognitive
 - Financial

For this study, it is proposed that three focus groups be held in urban area in Florida to explore these topic areas. The focus groups will be determined by cooperating with known service groups serving older populations. The samples will not be rigorously determined; however, the attendees will be asked sufficient information so that their basic representativeness with respect to basic demographic characteristics can be determined. The sample will be of older persons, not necessarily those who have ceased to drive or taken or failed the vision test. The focus group participant responses will not be verified with independent sources of information with respect to ability to use transit or actual transit availability and safety.

The product of this part of the research will be a technical report section documenting the series of focus groups and reporting their input regarding the unique considerations of transit that

influence the willingness to or actually use the mode by elders and elders who have ceased to drive.

Investigating actual travel behavior changes

An additional research opportunity would be to investigate actual travel behavior changes for the aging population. This could be carried out a number of ways including using a travel diary or conducting longitudinal surveys of individuals as they aged and moved through the driving cessation process, monitoring behavior thorough overall travel sample strategies (i.e., National Household Travel Surveys) or querying a sample of folks to provide recall information on travel in the past and present.

In light of the cost and schedule implications of defining a representative sample and gathering original data in this manner, it is proposed to develop a profile of older traveler travel behavior based on analysis of the Transportation and Availability Use Survey conducted in 2002 by the Bureau of Transportation Statistics and the 2001 National Household Travel Survey. The longitudinal nature of the NHTS survey will allow developing an understanding of how some travel behavior of older persons has changed over time. The BTS survey is relatively new and is currently being reprocessed to provide additional assurances that confidentiality is maintained for smaller geographies. Collectively, these national sources provide a rich data set that can provide an important understanding of older travel behavior. Sample sizes are such that some comparison of Florida versus the nation can be provided.

The product of this part of the research will be a technical report section documenting the most current state of knowledge regarding older person travel behavior. This will synthesize NHTS and BTS data into a profile of older traveler travel behavior.

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OVERALL SYNTHESIS

Comment on Work Not Proposed

Early work scope proposals included discussion of the prospect of direct data collection from the individuals who may have failed the vision exam to discern the impacts on their travel. While this would be an interesting research focus, it is not included here for a number of reasons. The single most critical reason is the difficulty in identifying the sample. The current research practice for identifying and sampling sensitive samples is to fuse databases to avoid violating the provisions that confidential contact information that is part of the license record not be used to contact individuals. Thus, a few other researchers have used the license database to identify the names of individuals who meet their sample criteria and then use other information sources to solicit address information for these individuals. For example, the work being carried out by Dr. Owsley includes a partnering relationship with the Insurance Institute. Names of individuals who have not passed the vision screening are then fed into their database to seek matches and those matches are then the basis of contact information for solicitation to participate in survey or focus group activities. Thus, the license database is not used to provide the information to contact individuals and technical compliance with confidentiality requirements is maintained.

An alternative strategy would be to solicit persons from a broader group who meet the target criteria. For example, one could use a mailing list from an agency that is well connected with the target population and solicit participation from persons who met the more narrow criteria. Thus, one might place an ad in a media targeted to seniors and solicit elders who have taken or failed a vision screening test if they would be willing to participate in a survey or other data collection exercise. This enrollment process, entirely voluntary, is similar to that that might be used for consumer research.

Both the above strategies require cooperation from service agencies, taking considerable time to be approved through the appropriate university Internal Review Board (IRB) channels governing human factors research for sensitive populations. This would take a considerable amount of time to facilitate, would be more expensive to administer than affordable in the scope of this work, and each involve the potential for sample biases and sample size problems.

However, in spite of the recommendation that new contacts with the sensitive population not be carried out as part of this effort, a follow-up survey or contact of the population sampled by Dr. Owsley may yet be a possibility. Should that be the case, some scope resource reallocation may be proposed.

Synthesis: The Market Opportunity for Public Transportation from an Aging Population

The greatest relevance of older traveler behavior to the public transportation industry is in gaining an understanding of the potential market opportunity and the implications in terms of the design and implementation of services. Thus, a significant effort of this overall research initiative will be to develop a composite picture of the market opportunity. This will involve integrating how the various personal characteristics and conditions combined with the travel options (from Figures 5 and 6) will produce various market segments that may be target markets for transit).

It is not at all uncommon to hear transportation professionals speak of the impending retirement and aging of the Baby Boom generation as both a great opportunity and challenge for transit. For the most part, this perception is based on a modestly-informed understanding of older person travel behavior both now and in the future. The perception that older persons will both cease driving and subsequently choose transit is a hypothesis only modestly tested against a richer understanding of actual travel behavior. The greatest contribution of this research is the opportunity to synthesize the research elements noted in prior sections into a composite profile of the market potential for public transit resulting from an aging population.

The research methodology proposed takes a mixed approach involving both quantitative and qualitative research methods. Quantitative research methods will involve the analysis of public datasets of travel behavior, population, driver licenses and so on. Qualitative research methods will involve focus group findings regarding attitude and awareness of public transit options. The benefit of using both quantitative and qualitative methodologies is that each method may have the potential of validating the other and filling in information gaps.

Figure 7 conceptualizes how the various data sources will be assembled into a composite profile of public transit market potential from an aging population. The resulting profile is expected to be useful in at least three key ways: 1) understanding potential demand and factors that influence it; 2) understanding needs such that service design and marketing can reflect that information; and 3) identifying policy issues and considerations that will influence the demand.

While each element of this research could individually absorb a far larger budget and benefit from a more rigorous data collection effort designed specifically to address the issue, the research team feels that this overall project is the most productive use of programmed resources. There is a demonstrated interest in this type of research and a strong interest in seeing the results. The proposed methodology for the remainder of the study is also robust in that its reliance predominately on existing data sources minimizes the uncertainties in schedule and cost.

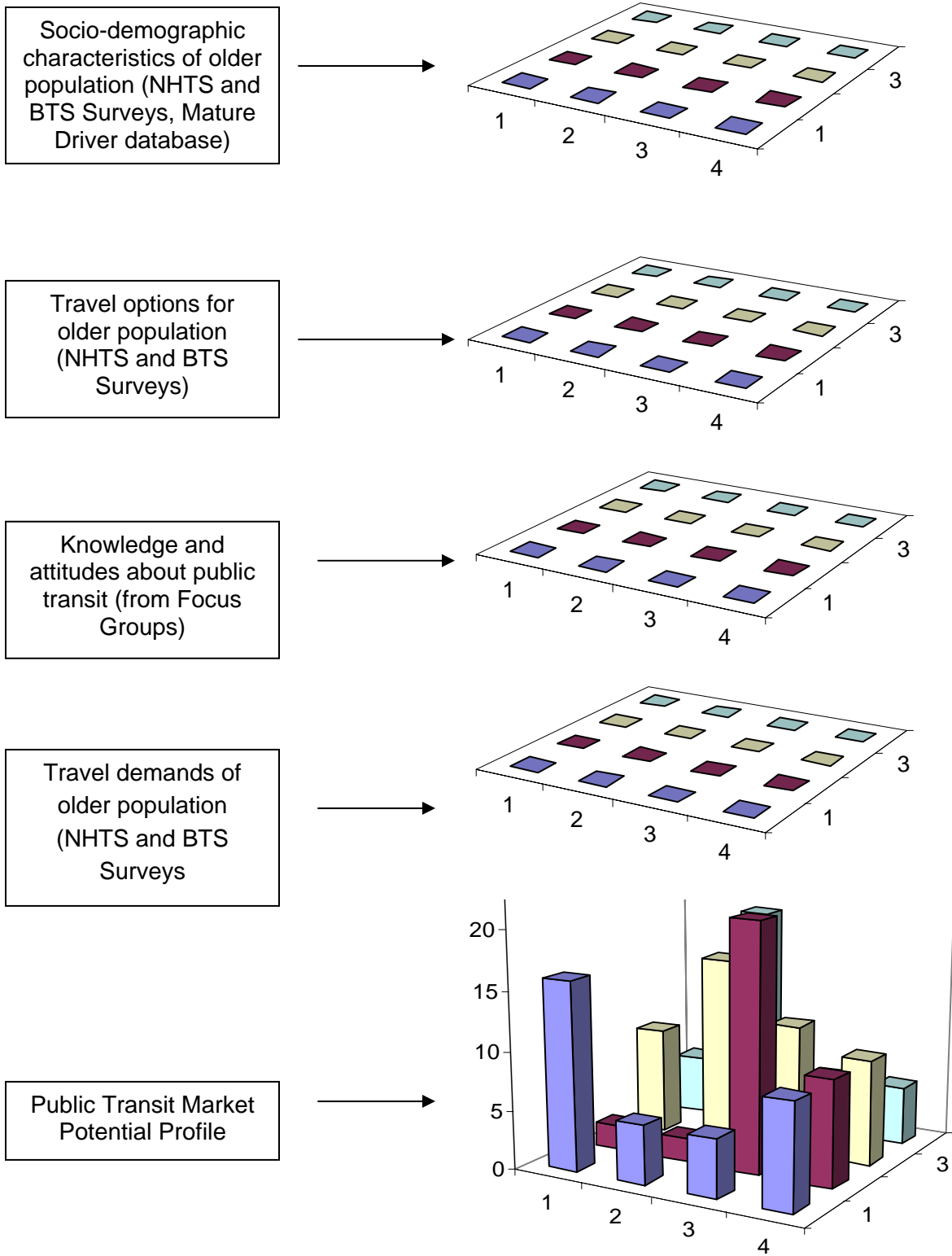


Figure 7 - Characterization of the Public Transportation Market Potential of an Aging Population

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REFERENCES

- 2004 Florida Statutes. *Title XXIII Motor Vehicles. Chapter 322 Drivers' Licenses.*
http://www.leg.state.fl.us/statutes/index.cfm?mode=View%20Statutes&SubMenu=1&App_mode=Display_Statute&Search_String=&URL=CH0322/Sec18.HTM
- Adler, G. & Kuskowski, M. (2003). Driving Habits and Cessation in Older Men with Dementia. *Alzheimer Disease and Associated Disorders*, Volume 17, Issue 2, pp. 68-71.
- Adler, G., Rottunda, S., Bauer, M., & Kuskowski, M. (2000). The Older Driver with Parkinson's Disease. *Journal of Gerontological Social Work*, Volume 34, Issue 2, pp. 39-49.
- Adler, G., Rottunda, S., Kuskowski, M. (1999). Dementia and Driving: Perceptions and Changing Habits. *Clinical Gerontologist*, Volume 20, Issue 2, pp. 23-34.
- Bauer, M.J. & Rottunda, S. (2003). Older Women and Driving Cessation. *Qualitative Social Work*, Volume 2, pp. 309-325.
- Berger, J.T. & Rosner, F. (2000). Ethical Challenges Posed by Dementia and Driving. *Journal of Clinical Ethics*, Winter; Volume 11, Issue 4, pp. 304-8.
- Burkhardt, J.E. (1999). *Mobility Changes: Their Nature, Effects, and Meaning for Elders who Reduce or Cease Driving.* Transportation Research Record No. 167, pp. 11-18.
- Burkhardt, J.E., Berger, A.M., & McGavock, A.T. (1998). *The Mobility Consequences of the Reduction or Cessation of Driving by Older Women.* In Women's Travel Issues: Proceedings from the Second Conference (Federal Highway Administration Publication FHWA-PL-97-024, pp. 439-454). Washington, DC: U.S. Department of Transportation, Federal Highway Administration.
- Campbell, M.K., Bush, T.L., & Hale, W.E. (1993). Medical Conditions Associated with Driving Cessation in Community-Dwelling, Ambulatory Elders. *Journal Gerontology*, Volume 48, Issue 4, pp. S230-4.
- Carr, D.B. (2000). The Older Adult Driver. *American Family Physician*, Volume 61, Issue 1, pp. 141-6, 148.
- Cobb, R.W. & Coughlin, J.F. (2004). *Transportation Policy for an Aging Society – Keeping Older Americans on the Move.* Transportation in an Aging Society A Decade of Experience Technical Papers and Reports from a Conference November 7-9, 1999. Bethesda, Maryland Transportation Research Board Washington, D.C.
- Coughlin, J.F. (2001). *Beyond Health and Retirement: Placing Transportation on the Aging Policy Agenda.* MIT AgeLab.
<http://www.subnet.nga.org/ci/assets/BeyondHealthRetirement.pdf>
- Coughlin, J.F. & Lacombe, A. (1997). Ten Myths about Transportation for the Elderly. *Transportation Quarterly*, Volume 51, Issue 1, ENO Transportation Foundation, Inc., pp. 91-100.
- Cutler, S.J. & Coward, R.T. (1992). Availability of Personal Transportation in Households of Elders: Age, Gender, and Residence Differences. *The Gerontologist*, Volume 32, Issue 1, pp. 77-81.

- Dellinger, A.M., Sehgal, M., Sleet, D.A., Barrett-Connor, E. (2001). Driving Cessation: What Older Former Drivers Tell Us? *Journal of the American Geriatrics Society*, Volume 49, Issue 4, pp. 431.
- Dobbs, B.M., Carr, D.B., Morris, J.C. (2002). Evaluation and Management of the Driver with Dementia. *Neurologist*, Volume 8, Issue 2, pp. 61-70.
- Evans, E.L. *Influences On Mobility Among Non-Driving Older Americans* (2001). Personal Travel: The Long and Short Of It Conference Proceedings June 28–July 1, 1999. Washington, D.C., Transportation Research Circular Number E-C026
- Foley, D.J., Heimovitz, H.K., Guralnik, J.M., & Brock, D.B. (2002). Driving Life Expectancy of Persons Aged 70 years and Older in the United States. *American Journal of Public Health*, Volume 92, Issue 8, pp. 1284-9.
- Fonda, S.J., Wallace, R.B., & Herzog, A.R. (2001). Changes in Driving Patterns and Worsening Depressive Symptoms Among Older Adults. *Journal Gerontology Series B Psychological Sciences and Social Sciences*, Volume 56, Issue 6, pp. S343-51.
- Forrest, K.Y., Bunker, C.H., Songer, T.J., Coben, J.H., & Cauley, J.A. (1997). Driving Patterns and Medical Conditions in Older Women. *Journal of the American Geriatric Society*, Volume 45, Issue 10, pp. 1214-8.
- Freedman, M.L. & Freedman, D.L. (1996). Should Alzheimer's Disease Patients be Allowed to Drive? A Medical, Legal, and Ethical Dilemma. *Journal of the American Geriatric Society*, Volume 44, Issue 7, pp. 876-7.
- Freund, B. & Szinovacz, M. (2002). Effects of Cognition on Driving Involvement Among the Oldest Old: Variations by Gender and Alternative Transportation Opportunities. *The Gerontologist*, Volume 42, pp. 621-633.
- Freund, K. *Surviving Without Driving – Policy Options for Safe and Sustainable Senior Mobility*. (2004). Transportation Policy for an Aging Society – Keeping Older Americans on the Move. Transportation in an Aging Society *A Decade of Experience* Technical Papers and Reports from a Conference November 7–9, 1999. Bethesda, Maryland, Transportation Research Board Washington, D.C.
- Frey, W.H. (2003). *Boomers and Seniors in the Suburbs: Aging Patterns In Census 2000*. Brookings Census 2000 Series, Washington DC: Brookings Institute - Center on Urban & Metropolitan Policy.
- Friedland, R.P. (1997). Strategies for Driving Cessation in Alzheimer Disease. *Alzheimer Disease Association Disorders*, Volume 11, Supplement #1, pp. 73-5.
- Gilley, D.W., Wilson, R.S., Bennett, D.A., Stebbins, G.T., Bernard, B.A., Whalen, M.E., & Fox J.H. (1991). Cessation of Driving and Unsafe Motor Vehicle Operation by Dementia Patients. *Archives of Internal Medicine*, Volume 151, No. 5.
- Haas, W.H., III & Serow, W.J. (1993). Amenity Migration Process: A Model and Preliminary Evidence. *The Gerontologist*, Volume 33, pp. 212-220.
- Hartford Financial Services Group (2000). *At the Crossroads – A Guide to Alzheimer's Disease, Dementia & Driving*. Hartford (CT).

- Hebert, K., Martin-Cook, K., Svetlik, D.A., & Weiner, M.F. (2002). Caregiver Decision-Making and Driving: What We Say versus What We Do. *Clinical Gerontologist*, Volume 26, Issue 1.
- Horowitz, A., Boerner, K., & Reinhardt, J. P. (2002). Psychosocial Aspects of Driving Transitions in Elders with Low Vision. *Gerontechnology*, Volume 1, Issue 4, pp. 262-273.
- Hunt, L.A. (2003). Driving and Dementia. Generations. *The Journal of the American Society on Aging*, Volume 27, Issue 2, pp. 34-38.
- Janke, M.K. (1994). *Age-related Disabilities that may Impair Driving and their Assessment*. Sacramento: California State Department of Motor Vehicles, National Highway Safety Administration.
- Jett, K., Tappen, R.M., & Rosselli, M. (2002). Imposed versus involved: Different Strategies to Effect Driving Cessation in Cognitively Impaired Older Adults. *Geriatric Nursing*, Volume 26, Issue 2, pp. 111-6.
- Kington, R., Reuben, D., Rogowski, J., & Lillard, L. (1994). Sociodemographic and Health Factors in Driving Patterns After 50 Years of Age. *American Journal of Public Health*, Volume 84, Issue No. 8, pp. 1327-1329.
- Kline, D.W., Kline, T.J., Fozard, J.L., Kosnik, W., Schieber, F., & Sekuler, R. (1992). Vision, Aging, and Driving: the Problems of Older Drivers. *Journal of Gerontology*, Volume 47, Issue 1, pp. 27-34.
- Kostyniuk, L.P. & Shope, J.T. (2003). Driving and Alternatives: Older Drivers in Michigan. *Journal of Safety Research*, Volume 34. Issue 4. pp. 407-414.
- Kostyniuk, L.P., Shope, J.T., & Molnar L.J. (2000). *Reduction and Cessation of Driving among Older Drivers in Michigan: Final Report*. University of Michigan Transportation Research Institute. Report Number UMTRI-2000-06.
- Longino, C.F. Jr. & Bradley, D.E. (2003). A First Look at Retirement Migration Trends in 2000. *Gerontologist*, Volume 43, Issue 6, pp. 904-7.
- Longino, C.F. Jr. (1995). *Retirement Migration in America*, Vacation Publications. Houston TX.
- Longino, C.F. Jr., Jackson, D.J., Zimmerman, R.S., & Bradsher, J.E. (1991). The Second Move: Health and Geographic Mobility. *Journal of Gerontology: Social Sciences*, Volume 46, pp. S218-S244.
- Longino, C.F. Jr., Perzynski, A.T., Stoller, E.P. (2002). Pandora's Briefcase: Unpacking the Retirement Migration Decision. *Research on Aging*, Volume 24, Issue 1, pp. 29-49.
- Marottoli, R.A., Ostfeld, A.M., Merrill, S.S., Perlman, G.D., Foley, D.J., & Cooney, L.M Jr. (1993). Driving Cessation and Changes in Mileage Driven among Elderly Individuals. *J Gerontology*, Volume 48, Issue 5, pp. S255-60.
- Marottoli, R.A., Mendes de Leon, C.F.M., Glass, T.A., Williams, C.S., Cooney, L.M. Jr., & Berkman L.F. (2000). Consequences of Driving Cessation: Decreased Out-of-Home Activity Levels. *Journal of Gerontology Series B Psychology Science Social Science*, Volume 55, pp. 334-340.
- Messinger-Rapport, B.J. & Rader, E. (2000). High Risk on the Highway: How to Identify and Treat the Impaired Older Driver. *Geriatrics*, Volume 55, No. 10, pp. 32-45.

- Office of Highway Policy Information - Federal Highway Administration. (2001) *Highway Statistics 2000*. Licensed drivers, by State, Sex, and Age Group Table DL-22. <http://www.fhwa.dot.gov/ohim/hs00/pdf/dl22.pdf>
- Owsley, C. (1997). Clinical and Research Issues on Older Drivers: Future Directions. *Alzheimer Disease Associated Disorders*, Volume 11, Supplement 1, pp3-7.
- Owsley, C. (2004). *Driver Capabilities*. Transportation in an Aging Society A Decade of Experience Technical Papers and Reports from a Conference November 7–9, 1999. Bethesda, Maryland Transportation Research Board Washington, D.C.
- Owsley, C., Ball, K., McGwin, G., Sloane, M.E., Roenker, D.L., White, M.F., & Overley, T. (1998). Visual Processing Impairment and Risk of Motor Vehicle Crash Among Older Adults. *Journal of the American Medical Association*, Volume 279, No. 14.
- Persson, D. (1993). The Elderly Driver: Deciding when to Stop. *Gerontologist*, Volume 33, Issue 1, pp. 88-91.
- Ralston, L.S., Bell, S.L., Mote, J.K., Rainey, T.B., & Brayman, S. (2001). Giving Up the Car Keys: Perceptions of Well Elders and Families. *Physical & Occupational Therapy in Geriatrics*, Volume 19, Issue 4.
- Rosenbloom, S. (1993). Transportation Needs of the Elderly Population. *Clinics in Geriatric Medicine*, Volume 9, Number 2, pp. 297-310.
- Rosenbloom, S. (2001). *Driving Cessation Among the Elderly; When Does it Really Happen and What Impact Does it Have?* Transportation Research Record, (National Research Council), Volume 1779, pp. 93 -99.
- Rosenbloom, S. (2003). *Older Drivers. Should we Test them off the Road?* Access. Number .23, pp. 8-13. University of California Transportation Center.
- Rosenbloom, S. (2004). *Mobility of the Elderly: Good News and Bad News*. Transportation in an Aging Society A Decade of Experience Technical Papers and Reports from a Conference November 7–9, 1999 Bethesda, Maryland Transportation Research Board Washington, D.C.
- Satariano, W.A., MacLeod, K.E., Cohn, T.E., & Ragland, D.R. (2004). Problems With Vision Associated Limitations or Avoidance of Driving in Older Populations. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, Volume 59, pp. S281-S286.
- Schiamberg, L.B. & McKinney, K.G. (2003). Factors Influencing Expectations to Move or Age in Place at Retirement Among 40- to 65-Year-Olds. *Journal of Applied Gerontology*, Volume 22, Issue 1, pp. 19-41.
- Schieber, F., Kline, D.W., Kline, T.J.B., & Fozard, J.L. (1992). *Contrast Sensitivity and the Visual Problems of Older Drivers*. Society of Automotive Engineers 1992 Annual Congress.
- Shope, J.T. (2003). What Does Giving Up Driving Mean to Older Drivers, and Why Is It So Difficult? Generations. *The Journal of the American Society on Aging*, Volume 27, No. 2, pp. 57 -59.
- Stanfield, R. (1996). Aging of America. *National Journal*, Volume 7, Issue 20, pp. 1578-1583.

- Sterns, H.L., Burkhardt, J.E., & Eberhard, J.W. (2003). Moving along the Mobility continuum: Past, Present, and Future. Generations. *The Journal of the American Society on Aging*, Volume 27, No. 2, pp. 8 -13.
- Stewart, R., Moore, M., Marks, R., May, F., and others. (1993). Driving Cessation in the Elderly: An Analysis of Symptoms, Diseases, and Medications. *Journal of Geriatric Drug Therapy*, Volume 8, Issue 2, pp. 45-60.
- Straight, A. (1997). *Community Transportation Survey Research Report*. AARP Public Policy Institute. http://assets.aarp.org/rgcenter/il/d16603_commtran.pdf
- Stutts, J.C., Wilkins, J.W., Reinfurt, D.W., Rodgman, E.A., & Van Heusen-Causey, S. (2001). *The Premature Reduction and Cessation of Driving by Older Men and Women*. Project G.7 Final Project Report University of North Carolina Highway Safety Research Center Chapel Hill, NC, <Http://Www.Hsrc.Unc.Edu/Pdf/2001/G7Report.Pdf>
- Taylor, B.D. & Tripodes, S. (2001). The Effects of Driving Cessation on the Elderly with Dementia and their Caregivers. *Accident Analysis & Prevention*, Volume 33, pp. 519-528.
- Trobe, J.D., Waller, P.F., Cook-Flannagan, C.A., Teshima, S.M., & Bieliauskas, L.A. (1996). Crashes and Violations Among Drivers with Alzheimer Disease. *Archives of Neurology*, Volume 53, Issue 5, pp. 411-416. American Medical Association. Chicago.
- U.S. Census Bureau (2005). *DP-1. Profile of General Demographic Characteristics: 2000*. Census Bureau. <http://www.census.gov/census2000/states/us.html>
- U.S. Census Bureau (2005). *U.S. Interim Projections by Age, Sex, Race, and Hispanic Origin*. U.S. Census Bureau, Population Division, Population Projections Branch <http://www.census.gov/population/projections/SummaryTabB3.xls>
- U.S. Department of Transportation (2004). *2001 National Household Travel Survey User's Guide Version 3 – National Sample with Add-Ons*. Washington DC. <http://nhts.ornl.gov/2001/usersguide/index.shtml>
- Waldorf, B. (2001). Anticipated Mode Choice Following Driving Cessation. *European Research in Regional Science*, Volume 11, pp. 22-40.
- Wang, C. & Carr, D. (2004). Older Driver Safety: A Report from the Older Drivers Project. *Journal of the American Geriatric Society*, Volume 52, pp. 143-9
- Wilkins, J.W., Stutts, J.C., & Schatz, S. (1999). *The Premature Reduction and Cessation of Driving: A Preliminary Study of Women who Choose not to Drive or who Drive Infrequently*. Transportation Research Record, Number 1693, pp. 86– 90.
- Yassuda, M.S., Wilson, J.J., & von Mering, O. (1997). Driving Cessation: The Perspective of Senior Drivers. *Educational Gerontology*, Volume 23, Issue 6, pp. 525-538.