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The Process of Reduction and Cessation of Driving Among Older Drivers: A Review of the Literature

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16. Abstract

Driving reduction and cessation were explored through a review of the literature. The dispersed landuse environment in the U.S. and the lack of suitable alternative transportation have made the automobile essential for mobility and the maintenance of a good quality of life. As people age, there are declines in vision, cognitive resources, and psychomotor ability, as well as declines due to the pathological effects of disease. These changes negatively affect the ability to drive. Aging drivers compensate for these changes by self-restricting where and when they drive, and by simplifying the driving task by eliminating distractions, avoiding unpredictable situations, and sometimes involving the assistance of another person. Driving cessation occurs when a person can no longer compensate and is usually brought on by a triggering event. Health problems are the main factor associated with cessation but stress and loss of confidence also contribute. Reactions to advice on the time to stop driving from family and friends are mixed and such advice is better received from physicians. Older drivers prefer to make the driving cessation decision themselves. Programs of peer and social support have been relatively successful in helping older persons adjust to not driving.

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1. INTRODUCTION

Mobility is a major determinant in the quality of a person's life (Carp, 1988). In present American society, it very often means driving one's own automobile. The dispersed land use patterns in the U.S., the growth of suburbs, and the present transportation system have made Americans extremely dependent on the automobile, while other modes of transportation remain inconvenient and cumbersome. Furthermore, the automobile in American society provides not only transportation, but is also important in maintaining one's independence, autonomy, and, in some cases, self-esteem. As people age, driving an automobile becomes more difficult. Physical changes associated with aging as well as various diseases take their toll on a person's ability to see, hear, process information, and react in a timely manner, all very important to safe driving. Curtailment of driving usually means relying on others for transportation, incurring the inconvenience of public transportation, or reducing the number of trips, and thus decreasing involvement in various activities and overall quality of life.

While many older drivers reduce their amount of driving, others stop driving altogether. Reduction of driving among older drivers is usually a result of the modifications made to compensate for declining driving ability. Complete cessation of driving may occur when additional compensation is no longer possible. It may be the result of a long continuous reduction process or the consequence of some catastrophic event that leaves a person unable to drive. A person's decision to stop driving may be voluntary, based on his/her own recognition of the situation, or perhaps influenced by family, friends, or health-care providers. Driving cessation could also be involuntary and occur when a department of motor vehicles takes away the older person's driving privileges.

This report is the first from a multi year research effort concerned with understanding the process of reduction and cessation of driving among older drivers. It summarizes a review of the literature on this and related topics and is organized into seven sections. This first section serves as an introduction. The second section briefly describes the driving patterns of older drivers. The third section examines the need to drive in the

current land use environment of the U.S. Age-related declines in the abilities needed to drive are addressed in the fourth section. The fifth section examines self-regulation and other strategies used by older drivers to compensate for their declining abilities to drive. The sixth section is concerned with the decision-making process regarding driving cessation, including the influences of family, friends, peers, and authorities. The last section identifies research questions and gaps in existing knowledge.

It should be noted that there is no precise age at which a driver becomes an older driver. While most studies consider the age of 65 years as the demarcation, other studies categorize drivers as older at age 55 and some at age 70. This report follows the most widely accepted convention of considering drivers as older starting at age 65.

2. DRIVING PATTERNS OF OLDER DRIVERS

Studies have shown that the driving patterns of older people differ from those of younger drivers (e.g., Benekohal, Michaels, Shim and Resende, 1994; Eberhard, 1996). Lifestyle transitions that correspond with age influence driving activity, destinations and mileage driven. Retirement eliminates the regular commute to a workplace and affords older individuals more flexibility in their choices of when to drive. Types and frequency of recreation and social excursions change also with age, thus affecting travel patterns (Eberhard, 1996).

In the U.S., people age 65-74 drive about half the annual mileage of drivers age 35-44, with mileage declining even further after age 75 (Eberhard, 1996; Evans, 1988; TRB, 1988). The annual mileage figures from the 1995 National Personal Transportation Survey showed that people age 40-44 drove an average of about 14,300 miles per year, while people age 65-69 drove about 8,500 per year. People in the age 75-79 age group drove about 5,900 miles per year (Federal Highway Administration, 1998).

Despite the lower mileage, older drivers do not necessarily make fewer trips than other drivers. When commuting trips to work are excluded, older drivers appear to make as

many trips as younger drivers. A study that examined the driving patterns of a sample of 664 Illinois drivers, 66 years of age and older (Benekohal et al., 1994), found that 70 percent of these drivers drove at least 5 days a week, and 42 percent drove daily, although the frequency of driving dropped as age increased. The study also reported that drivers age 66-76 drove an average of 5.7 days a week while drivers over age 77 drove an average of 4.4 days a week. About 15 percent of drivers drove their car more than once in a given day. Men tended to drive more frequently than women.

Trips taken by older drivers tend to be shorter, closer to home, and for different purposes than those of other drivers (Benekohal et al., 1994; Chu, 1994). As the age of drivers increases, the frequency of trips to work and for recreational and social activities decreases. The most common purpose for trips among older drivers is grocery or personal shopping. Benekohal et al. (1994) reported that in their study of Illinois drivers over 65 years of age, 45 percent of trips were for shopping. The types of trips taken differed between men and women. Women reported that the main purpose for their trips was for grocery and other shopping, while the main purpose of trips reported by men was for social, recreational, and medical visits.

Trip patterns of older drivers differ from those of other drivers by time of day. In general, older drivers avoid driving at night (Benekohal et al.,1994; Chu, 1994; Gianturco, Ramm, and Ervin, 1974; Kington, Reuben, Rogowski, and Lillard, 1994; Kosnik, Secular, and Kline, 1990; Mortimer, 1988; Stewart, Moore, Marks, May, and Hale, 1993; Stutts, Waller, and Martell, 1989). Nighttime mileage shows the largest decline beginning with the 55-65 age group and continues to decline after age 65 (Stutts et al., 1989). Benekohal et al. (1994) found that about 25 percent of older people in their sample drove during the evening and at night, but less than 1 percent drove after midnight. As drivers aged, they were likely to further decrease their nighttime driving.

As a group, older drivers tend to avoid heavy traffic conditions, especially those during

peak periods (Benekohal et al., 1994; Persson, 1993). There is some evidence that older drivers are less likely than others to use freeways (Chu, 1994), although some researchers argue that freeway avoidance may actually be the avoidance of congested places and times of day (e.g., Lerner, Morrison and Ratte, 1990). Older drivers are less likely than others to drive in adverse weather conditions and, as a group, show a tendency to avoid driving during conditions of snow, ice, and rain (Benekohal, 1994; Stewart et al., 1993). Older drivers also tend to drive at lower speeds than others on the same roads (Chu, 1994; Forrest, Bunker, Songer, Coben, and Cauley, 1997; Wasielewski, 1984), and leave more distance between vehicles (Evans and Wasielewski, 1983).

3. THE NEED TO DRIVE

A person may need to drive an automobile to fulfill basic needs, such as acquiring food and obtaining health care, as well as to fulfill such social needs as visiting friends and relatives, and reaching various activities. The extent of this need to drive depends on the distance from where the person lives to the locations of these activities and available transportation options. With the growth of suburbs, the distances between these locations increased and dependency on the automobile grew.

Since 1970, the proportion of older suburban dwellers has been steadily increasing, while the proportion of those living in central cities has been decreasing (Golant, 1990). According to the U.S. Census Bureau, in 1988, 57.4 percent of people over age 65 from metropolitan areas lived in the suburbs. By the year 2000, it is expected that 75 percent of people over age 65 will live in suburban or rural locations (Rosenbloom, 1993).

Availability of Alternatives

Residents of suburban areas have few transportation options besides the automobile. Most older individuals are able to function in suburban areas *because they drive* (emphasis original, Rosenbloom, 1993). Indeed, Carp (1972) found that among older

non driver, location of residence seemed to affect their dependency on rides from others. Non driver who lived in the suburbs insisted that they could not maintain the necessities of life if their rides from others ceased. Non driver who lived in the urban-suburban areas closer to a city center thought that they could probably find other transportation for basic necessities if their rides from others ceased, although they might need to give up some things that they like to do. Finally, non driver who lived near the city center felt confident that they could find alternate transportation, including walking, to do most things that they needed and wanted to do.

When older residents of suburbs do not drive, they rely on others with cars, or they walk, and only rarely use public transit (Rosenbloom, 1993). In 1990, only 1 to 3 percent of trips taken by people over age 65 in the U.S. were on public transit and 6 to 10 percent of trips were by walking. In contrast, the vast majority of trips–81 to 91 percent-were by private vehicle with the older person as driver or passenger. Clearly, automobiles remain the transportation mode of choice.

Because very few public transit options provide the mobility, convenience, and security that a car provides, older individuals do not take advantage of public transit and other special services, such as door-to-door paratransit, which may be offered by their communities. Rosenbloom (1988) asserted that, contrary to popular belief, older people do not use public transit, not because they cannot afford it or get on it, but rather because it is not responsive to their travel needs; that is, it does not go where and when they want to go. Traditional transit is inadequate to serve the travel patterns of a suburban population. Because older persons are more likely to live in areas with low population densities and to make extensive suburban-to-suburban trips, public transit has not proven to be a suitable alternative for them.

Rosenbloom (1993) noted that it may have been assumed that older people who had to stop driving and could not use fixed-route buses would then use special transit services. However, special transit services are usually limited to restricted service areas, for

certain types of trips, require advance reservations, and do not replace the mobility lost by driving cessation. Since implementation of the Americans with Disabilities Act (ADA) in 1990, transit systems must provide both fixed-route and special transit services to the disabled population; that is, they are mandated to provide a much higher level of service to a specific, narrowly defined subset of persons, that does not include a large portion of the older population. Provision of ADA-mandated service consumes a large portion of available resources, leaving less for special transit services for older persons. Rosenbloom pointed out that the institution of ADA-mandated services to disabled non elderly people may even further erode the tenuous benefits special transit service offers the older population.

Rides From Others

There may also be a psychological need to drive which stems from the feelings of independence, autonomy, and self-esteem that having control of one's own mobility provides (Carp, 1988; Gonda, 1981). Many older former drivers depend on family and friends to provide transportation needs. While accepting rides as a passenger has benefits such as personal contact to combat loneliness, this option can exact a psychological price on the older passenger. In a study of over 700 community-dwelling older non drivers, Carp (1972) found that older passengers identified negative aspects regarding the acceptance of rides, such as feelings of indebtedness which became burdensome and demeaning when reciprocation was impossible; schedules or routes of drivers that did not meet their needs as passengers; and nervousness about the driving skills of the people who offered rides.

Other drawbacks to obtaining rides from others, mentioned by older people in Carp's (1972) study, were first, a scarcity of available rides, and second, that these rides did not meet their shopping, medical, and social needs. Carp found that 3 percent of the people in her sample were driven someplace almost daily; 50 percent could count on weekly rides; 33 percent were given rides two to three times a year or less; and 13 percent were never given rides. When examining who was offering the rides, it was

found that relatives provided rides for about 62 percent of the non drivers; friends provided rides for about 33 percent of them; and staff of a service agency or other organization provided rides for only 3 percent of the non drivers. It is important to note that since the early 1970s when Carp's interviews were conducted, social changes have occurred in the U.S. which affect the availability of family members to provide transportation for their older relatives (Morrison, 1990). Most notably, many more women have entered the labor market for paid employment. This change has altered the traditional support structure within families and decreased the time available for caring for aging parents or other relatives. This change has profound implications on the well-being of older people because family members provide most of the care, including transportation, that non institutionalized elderly people receive.

Relocation

Relocating is often an environmental adaptation made by older people who are seeking places to live that are consistent with their lifestyles, personal resources, and limitations (Golant, 1987). Moving to a location or into a setting where driving is less essential for meeting the basic necessities of life are ways of addressing mobility problems. In a study that examined driving, sociodemographics, and health factors of over 2,400 adults over age 50, Kington et al. (1994) found that older persons who have stopped driving tended to live in households with more adults. A possible explanation for this, noted by Kington and his research team, is that older people may be more likely to stop driving when other adults are readily available to drive, or older adults who can no longer drive may choose living arrangements that provide a group of available drivers.

The reasons why older people relocate are varied, but it appears that moves in later life correspond to changes in levels of care required from others. These levels of care are inversely related to changes in driving ability. Many relocation and migration studies (Colsher and Wallace, 1990; Silverstein, 1995; Speare and Meyer, 1987) are based on a migration model developed by Litwak and Longino (1988). This model predicts three stages in later life that motivate relocation decisions among the elderly.

The first stage in the Litwak and Longino model begins at the onset of retirement, which may motivate moves to locations offering leisure activities, warm weather, and lower housing costs. Only a small number of older people are motivated to relocate due to retirement. The second stage of later life starts with the onset of disability or limitation and may motivate older people to return to their home community, to a community where children or other relatives can better care for them, to an assisted living facility, or to a retirement community. The timing of this move is often accelerated by the death of a spouse. The third stage of later life starts after severe disability causes a need for care that is greater than informal care givers, such as adult children, can provide and is usually accompanied by a move to an institution.

Although studies have examined declining health as a factor in moving one's place of residence, no studies were found where driving was isolated and examined for its contribution in such decisions. The ability to provide for one's own transportation however, appears to be an implicit factor in all these studies. A study by Walcoff and Associates (1994) did note that lack of mobility may hasten the transition from independent living to institutional living.

4. DECLINES IN THE ABILITY TO DRIVE

As people age, there is a decline in the abilities needed to operate an automobile safely and effectively. Changes associated with aging, such as the decline of vision, hearing, attention resources, reaction time, flexibility and motor ability, negatively affect the ability to drive. The ability to drive is also affected by the pathological effects of various diseases as well as by the medications taken for these diseases.

Vision

It is estimated that 90 percent of the information needed for the driving task is acquired through vision. Visual acuity, the ability to perceive spatial detail at a given distance, declines with age (e.g. Olzak and Thomas, 1986). Specifically, static visual acuity or

the ability to perceive spatial detail while standing still begins to decline at about age 45 and declines more rapidly as age increases (Owsley and Sloane, 1990). Dynamic visual acuity, the ability to perceive details while moving, starts declining even earlier and the decline tends to be steeper than that for static acuity (Burg, 1966). Older people also need two to three times the luminance required by younger people in order to see comparably well (Owsley and Sloane, 1990; Weale, 1982). Further, there are significant age-related declines in contrast sensitivity, particularly at lower levels of light (Owsley, Sekuler and Siemsen, 1983; Kline, Schieber, Abusamra and Coyne, 1983). Schieber, Kline, Kline and Fozard (1992) found that age-related declines in contrast sensitivity are related to the frequency and magnitude of self-reported vision and driving problems.

Compounding the problem of declining vision in low light is the slower adaptation to the dark experienced by older people (Domey, McFarland, and Chadwick, 1960; McFarland, 1968; McFarland, Domey, Warren, and Ward, 1960), although some studies have found no age differences (Birren and Shock, 1950; Eisner, Fleming, Klien and Mauldin, 1987). The time it takes to recover from glare, such as that from oncoming headlights, however, is clearly much longer for older people than for younger people (Brancato, 1969). Wolf (1960) found that in order to see an object after a glare stimulus, older adults required the object to be significantly brighter than did younger people. In Wolf's study, people in the 75-80 year range needed the object to be 50 to 70 times brighter to be reliably seen than did people in the 5-15 year old age group.

Peripheral vision is also affected by age and begins to decline after about 55 years of age (Burg, 1968; Crassini, Brown and Bowman, 1988; Wolf, 1967). Peripheral vision is significantly reduced in people 75 years of age or older (Wolf, 1967). Indeed, motor vehicle crashes have been associated with constricted visual fields (Schieber, 1994). In addition, the useful field of view (UFOV), a cognitive capacity with visual elements utilizing visual field, has been shown to decrease among older drivers and has been

related to crashes among older drivers (Owsley and Ball, 1993; Owsley, Ball, Sloane, Roennher, and Bruni, 1991).

Declines in visual perception lead to driving difficulties, especially at night when light levels are low and there is glare from oncoming headlights. In addition, at night, critical information such as that from signs, traffic signals and other visual stimuli, may be more difficult to obtain (Allen, 1985; Staplin and Lyles, 1987). Sivak, Olson, and Pastalan (1981) found that nighttime legibility of signs is particularly problematic for older drivers. It appears that older drivers restrict their exposure to these specific difficulties, by avoiding night driving, especially in unfamiliar locations (Benekohal et al., 1994; Eberhard, 1996) which may be due in part to difficulty seeing signs, signals, and landmarks.

Cognitive Ability

The ability to ignore irrelevant information has been shown to decline with age (Layton, 1975; Rabbitt, 1965; Ranney and Pulling, 1989; Salthouse, 1991; Temple, 1989). In a review of studies that examined attention and driving performance, Parasuraman (1991) found that higher positive correlations between crash rates and low scores in attention tests were found in studies that included older drivers than in those studies that did not, indicating that attention deficits are more prevalent among older drivers. Crash statistics and observation studies suggest that older drivers are particularly challenged by situations that require divided attention and/or rapid decision making. Examples of two such situations are turning left at an intersection and perceiving relevant traffic signs (Kahneman, 1973; Mihal and Barrett, 1976; van Wolffelaar, Brouwer and Rothengatter, 1991).

Selective attention in particular, has been studied for its relevance to older driver performance. Numerous studies have found a relationship between traffic crashes and selective attention performance (Avolio, Kroeck, and Panek, 1985; Barrett, Mihal, Panek, Sterns, and Alexander, 1977; Kahneman, Ben-Ishai, and Lotan, 1973; Mihal

and Barrett, 1976; Ranney and Pulling, 1989). Selective attention tasks that require older people to discriminate between relevant and irrelevant stimuli are particularly difficult (Brouwer and Ponds, 1994). This poses a problem because the ability to re-orient attention rapidly away from irrelevant stimuli and toward relevant stimuli is an important component of the driving task (Kahneman et al., 1973). Indeed, in Parasuraman's study (1991) the highest correlations between crash rates and tests that measured errors in attention were found for selective attention, and the strength of this association was stronger for older than for younger drivers.

Motor vehicle crashes can result when, due to inattention, drivers make no avoidance maneuvers or take action too late to avoid a collision. A study that examined driver-related factors in crash avoidance (Sussman, Bishop, Madnick, and Walter, 1985) found that failure to respond increased linearly with driver age. Failure of older drivers to carry out an appropriate avoidance maneuver was also found in a study of fatal intersection crashes involving older drivers in Finland (Hakamies-Blomqvist, 1993). In these crashes, the older driver typically did not see the crossing vehicle or saw it too late to take action.

Driving is an activity that requires ongoing decision making (West, Elander, and French, 1992). Drivers make relatively rapid decisions regarding their control of the vehicle, obstacle avoidance, what speed to drive, whether or not to overtake another vehicle, and whether or not to pull out into traffic. Decisions at all levels involve acquiring information, assessing the implications of various actions, and choosing and performing an action.

Older persons may be more likely to reach the limits of their information processing capability while driving than younger persons (Sivak, 1994). A significant correlation has been found between the "hesitancy" aspects of decision making and crash rates among people over age 60 (French, West, Elander, and Wilding, 1993; West et al. 1992). Correlations between the "thoroughness" aspects of decision-making and crash

rates among people over age 60 have also been found (French et al., 1993; Reason, Manstead, Stradling, Parker, and Baxter, 1991; West et al., 1992). This finding may be because among older drivers, the ability to process information rapidly is impaired (Holland and Rabbitt, 1991). When encountering potential traffic hazards, the speed of processing information about the hazards may play a role in crash risk and in the extraction of the necessary information from the visual scene of the hazard (West et al., 1992). Salthouse (1994) concluded that processing speed may be a key factor in the relationship between age and cognition and that slower processing speed would impair the quality of decisions, above and beyond taking longer to reach decisions and act on them. If older drivers do not compensate for this impairment through some strategy, or if they begin driving maneuvers and then change their minds, crash risk could be increased (West et al., 1992).

Many studies indicate that the deterioration of cognitive processing due to aging effects way-finding skills. For example, a study of the spatial abilities of older persons (Walsh, Krauss, and Regnier, 1981) found that older adults were less familiar with the geography of their neighborhoods than younger people, and tended to be less accurate and organized in drawing maps of their neighborhoods. Ohta (1983) and Kirasic and Allen (1985) found that older individuals developed inefficient and inaccurate route plans and recognized fewer landmarks than did younger people. Salthouse (1987) reported that age-related reduction in spatial orientation ability may affect map reading and navigational skills. Aubrey, Li, and Dobbs (1994) found that older subjects had more difficulty than younger subjects when reorienting contra-aligned maps.

Psychomotor Ability

Reaction time includes physical, perceptual, and cognitive components (Marottoli and Drickamer, 1993). When joints become arthritic and muscles become tighter, driving abilities dependent on reaction time can be affected. These physical changes mean that even if perceptual and cognitive-level abilities remain unchanged, the physical effects of aging can increase reaction time because the muscles and joints may not be

able to respond quickly enough (States, 1985). However, age-related increases in reaction time have been shown to be primarily due to differences in information-processing time rather than movement time, and reaction time may be more affected by cognitive changes than by changes in motor skill (for discussion see Cerella, 1990; Marottoli and Drickamer, 1993; Salthouse, 1985). Thus, it appears that increases in the reaction time of older drivers are mostly attributable to changes in their perception and cognition.

Numerous age-related changes and health problems can affect the motor ability and flexibility needed to operate an automobile. Joint flexibility, muscle strength, and muscle mass diminish with age due to less active use during manual labor, sports, or stretching exercises (States, 1985). Decreased head and neck mobility is common among older drivers. In Yee's (1985) survey of the needs and problems of drivers over age 55, 21 percent reported that it was "somewhat difficult" to turn their heads and look to the rear when driving or backing up. Restrictions in the range of neck motion can impede a driver's ability to perform basic driving tasks, such as scan to the rear, back up, park, and observe blind spots (Bulstrode, 1987; Janke, 1994; Malfetti, 1985).

One medical condition that may also affect these abilities is arthritis (Bulstrode, 1987; Cornwall, 1987; Roberts and Roberts, 1993). Arthritis is a common ailment among the elderly with over 50 percent of the older population having osteoarthritis and about 2 percent having rheumatoid arthritis (Roberts and Roberts, 1993). Reports of driving difficulties are prevalent among older drivers with arthritis; in one survey of the needs and problems of drivers over age 55, 35 percent of older drivers reported problems with arthritis (Yee, 1985) and nearly half of older persons with osteoarthritis and 60 percent with rheumatoid arthritis experienced symptoms every day, reporting "much distress" (Epstein, Yelin, Nevilt, and Framer, 1986).

Other medical conditions that affect flexibility and motor skills include ankylosing spondylitis, which is arthritis of the spine (States, 1985) and Parkinson's disease

(Poser, 1993). Low back pain is also a common complaint of older drivers (States, 1985). These physical changes and health problems can affect driving by causing decreased flexibility, increased discomfort and pain, difficulty moving limbs and extremities, and fatigue.

In general, discomfort or pain while seated or while engaging in the motions of driving can impair driving ability by slowing or preventing appropriate responses; this can be particularly problematic when responding to emergency situations (States, 1985). The pain and restriction of joint movement caused by arthritis are of primary importance in the assessment of arthritis' impact on driving (Cornwall, 1987). McPherson, Michael, Ostrow, and Shaffron (1988) found that older adults with less joint flexibility exhibited poorer on-road driving ability than those with wider ranges of motion. Any condition that affects the spine can affect driving capability. The spine plays a central role in driving because it is the principal supporting element of the human body. The ability of a driver to remain upright and move is mostly dependent on the spine. Any limitation of motion in the cervical spine limits head rotation and vision to the side, possibly leading to an increased frequency of side-impact crashes (States, 1985).

Health Factors

A common health problem among older people that can affect driving is cardiovascular disease, a chronic, progressive and disabling disease which is the leading cause of death in the U.S. among people age 65 and over (Kannel, Gagnon and Cupples, 1990). Angina, a pressure-like chest pain, is a symptom in most older patients with this disease (Wielgosz and Azad, 1993). There is consensus in the literature that unstable angina precludes any driving, and a patient should wait a month after an episode before resuming driving because it may be predictive of an impending sudden incapacitating cardiac event (Canadian Cardiovascular Society, 1996; Wielgosz and Azad, 1993). Such an event would be dangerous if it occurred while driving, however, the risks of this happening have been found to be minimal (Epstein, Miles, Benditt, Camm, Darling,

Friedman et al., 1996), and less than other driving risks that are widely accepted by society.

Treatments used to manage arrhythmia, or an irregular rhythm of the heart, can also affect driving ability. Implantable cardioverter-defibrillators (ICDs) prevent sudden cardiac death by terminating life-threatening arrhythmias through a high-energy shock. This shock can sometimes result in near or complete loss of consciousness, presenting an obvious danger if an individual is driving at the time (Epstein et al., 1996; Kou, Caulkins, Lewes, Bolling, Kirsh et al., 1991). The Canadian Cardiovascular Society recommended that patients using antiarrhythmic drugs refrain from driving for 3 to 12 months, depending on type of drug that is being taken and the presence of an ICD (1996). Another arrhythmia management device, the pacemaker, has not been associated with driving problems in the literature (Brandaleone, 1974; Canadian Cardiovascular Society, 1996; Epstein et al., 1996).

Stroke is a common health condition among the older population. As age increases, there is an increase in the prevalence and mortality rates of stroke and the prevalence rate of stroke among people over age 65 is approximately 5 to 10 times higher than the rate for the general population (Kurtzke, 1985). The ability to drive after stroke depends on the resulting disorders. Some disorders that commonly follow stroke, such as partial or incomplete paralysis of the upper and lower extremities, can be compensated for by converting automobile controls if these are the only disabilities present (Lings and Jensen, 1991). Other, more subtle cognitive disorders that can result from stroke are of great relevance to traffic safety (Lings and Jensen, 1991), and they can be more difficult to compensate for. There is much variation in driving capability among stroke patients. Some stroke patients are affected so severely that they cannot drive. Others continue to drive although there is some degree of decrease in their driving skills. For still others there is little noticeable change from their previous driving ability (van Zomeren, Brouwer and Minderhouch, 1987).

Diabetes is a common health problem among U.S. adults age 65 or older. It has been estimated that 18-20 percent of older adults have diabetes (CDC, 1997; Davidson, 1991). The prevalence of diabetes increases with age (Davidson, 1991; Hansotia, 1993; Hu, Young, and Lu, 1993), and age has been found to be an independent risk factor for developing the disease (Davidson, 1991). Driving can be affected by the hypoglycemic episodes that may occur among people being treated for diabetes. Hypoglycemia is a condition of low blood sugar that can affect overall brain function and lead to loss of consciousness (Hansotia, 1993). This is the most pressing concern related to the decision regarding whether a person with diabetes should drive. The risk of potential driving problems differs depending on the type of diabetes a patient has. Hypoglycemia is most likely to occur in people with Type 1 diabetes or those who are insulin-dependent (Ehrlich, 1991). These people comprise only 5 to 10 percent of the total diabetic population. Because most older people with diabetes have Type 2 non-insulin dependent diabetes, the risk of hypoglycemic episodes seems small. However, for those who do experience hypoglycemia, debilitating impairment of judgment and insight can occur with or without warning (Haunz and Brosseau, 1984). Haunz and Brosseau warn that because patients with "non warning hypoglycemia" will often avoid disclosing the condition, direct inquiry by physicians and involvement of family and friends is needed to ensure safety.

Corresponding with the increased prevalence of health problems, the use of medications also increases with age. More than 80 percent of people age 65 and over receive one or more prescribed medications (Moeller and Mathiowetz, 1989). Some medications used extensively by ambulatory older individuals can have adverse effects on driving (Ray, Thapa, and Shorr, 1993). These medications include benzodiazepines such as tranquilizers and anti anxiety drugs, antidepressants, analgesics, antihistamines, and hypoglycemics. All of these drugs can either directly or indirectly affect the central nervous system, which in turn can impair driving ability and increase the risk of crashes (Betts, Markman, Debenham, Mortiboy, and McKevitt, 1984; Gengo, Gabos, and Miller, 1989; Hindmarch, 1986, 1988; Leveille, Buchner, Koepsell,

McCloskey, Wolf, and Wagner, 1994; Louwerens, Brookhuis, and O'Hanlon, 1984; Nakra, Gfeller, and Hassan, 1992; Nicholson and Stone, 1982; Ray, Thapa, and Shorr, 1993; Smiley, 1987).

Multiple medications can compound driving impairment and older people may be more likely to be using several medications. In one study of older community-dwelling women, people reported using an average of two prescription drugs each, and 20 percent reported using four or more prescription medications (Cadigan, Magaziner, and Fedder, 1989).

5. COMPENSATING BEHAVIORS

The decline of physical, cognitive, and psychomotor abilities related to driving may be accompanied by a decrease in comfort level and an increase in anxiety and stress associated with driving in specific situations. Older drivers seem to compensate for these feelings by self restricting, that is, not driving in situations that make them uncomfortable, and by reducing the mental load of the driving task by simplifying it. This simplification of the driving task is accomplished by eliminating distractions, avoiding unpredictable situations, and by sometimes involving the assistance of another person. These compensation behaviors may not only reduce the stress and anxiety older drivers feel in certain driving situations, but also may reduce their risk from driving in these situations.

Self-Restriction

Older drivers tend to avoid uncomfortable and stressful driving conditions by self-restricting where and when they drive. Well-documented examples of self-restrictive driving behavior among older drivers include avoidance of driving at night, in inclement weather, and in heavy traffic (e.g., Benekohal et al., 1994; Giaturco et al., 1974; Kington et al., 1994; Kosnik et al., 1990; Mortimer, 1988; Stewart et al., 1993; Yee, 1985).

Unfamiliar areas are increasingly avoided as drivers age. Avoidance of unfamiliar areas, especially at night, was reported in focus group study of older drivers in rural and urban areas of Illinois (Benekohal et al., 1994). A cross-sectional examination of the association between driving patterns and medical conditions in women over age 70, that looked at driving patterns of more than 1,400 older women drivers and former drivers, found that the oldest drivers were more likely to not drive in the dark, on ice and snow, on highways, or on unfamiliar roads (Forrest et al., 1997). In addition, as age increased, these women no longer drove on long trips. A curtailment of driving in inclement weather and on long trips was also reported in a study of driving cessation by the elderly conducted by Stewart et al. (1993).

While it may be commonly believed that older drivers avoid freeway driving, several survey and focus group studies of older drivers did not find a drastic reduction or cessation of freeway driving (Knoblauch, Nitzburg, and Seifert, 1995; Lerner et al., 1990). Rather, older drivers tended to avoid freeways during certain times, such as congested rush hours, nighttime, bad weather, and in unfamiliar areas. In fact, they used the same compensation strategies on freeways that they used on other roads, and their reduction of driving on freeways was proportional to their reduction on other roads (Knoblauch et al., 1995; Lerner et al., 1990).

The self-restrictive driving behavior of older drivers limits their exposure which is reflected in their crash patterns. Most crashes involving older drivers occur in clear weather and non-peak traffic periods (Eberhard, 1996). In an analysis of crash data and interviews with over 900 older drivers in British Columbia, Cooper (1989) found that the proportion of crashes occurring between 9:00 a.m. and 3:00 p.m. increased for each 10-year increment above age 55. He also found a corresponding decrease in nighttime crashes with each 10-year increment above age 55. These rates clearly reflect differences in exposure, because drivers tend to increasingly avoid bad weather, peak traffic periods, and nighttime driving as they age.

Simplifying the Driving Task

In addition to avoiding certain driving situations, older drivers adapt their driving to accommodate the sensory, cognitive, and motor changes they have experienced (Benekohal et al. 1994). For example, attention deficits in processing and responding to traffic information are compensated for by turning off the radio, avoiding busy intersections, not driving with a distracting companion (Brouwer and Ponds, 1994) and by driving more slowly (Forrest et al., 1997; Hakamies-Blomqvist, 1994). In one focus group study, older drivers discussed their concern about driving in complex driving environments. They reported that they selected routes that were less complex and, whenever possible, avoided unpredictable situations (Benekohal et al.,1994). A study of driving cessation conducted by Stewart et al. (1993) reported that older drivers tended to avoid busy intersections. Interviews with a sample of older drivers (average age 78.3) from a longitudinal study of aging revealed that most of these older drivers had restricted their driving to necessary trips in the neighborhood and city, and that they had deliberately chosen circuitous routes to avoid highways (Giaturco et al., 1974).

Older drivers also have made adaptations to freeway driving. Studies (e.g., see Knoblauch et al., 1995; Lerner et al., 1990) have reported that many older drivers prefer to drive in the center lane of multi lane freeways because it gives them access to exits on either the right or left and also allows other vehicles to pass, merge, or exit. However, some older drivers indicated a preference for the right lane because it is the "slow lane." Others preferred the left lane because they only had to worry about other cars on one side. Older drivers tended to stay in one lane and changed lanes infrequently (Lerner et al., 1990). In the same studies, older individuals reported feeling most comfortable while driving near the 55 mph speed limit or generally slower than other freeway drivers (Knoblauch et al., 1995; Lerner et al., 1990). It should be noted that both studies were published before the recent widespread adoption of 65 and 70 mph speed limits on freeways, therefore it is not yet known whether or how these faster speeds have affected older drivers' freeway driving.

Another way to simplify the driving task is to obtain assistance from a passenger acting as a copilot, with tasks such as reading street signs, looking out for traffic, landmarks, or reading maps (Kostyniuk, Streff, and Eby, 1997; Shua-Haim and Gross, 1996; Persson, 1993). In a focus group study of navigation by people over age 65, two-thirds of the participants noted that they relied on a copilot more often now than they did when they were younger, and some mentioned their dependency on copilots (Kostyniuk et al., 1997). Other studies of freeway driving also found that older drivers depended on a passenger who served as a navigator (Knoblauch, et al., 1995; Lerner et al., 1990).

For these older drivers, the copilot served a number of specific functions that are consistent with the changes in perception and cognition that older persons experience as they age (Kostyniuk et al., 1997; Shua-Haim and Gross, 1996). The copilot's help allowed the driver to overcome deficits that otherwise may have limited driving ability, for example, seeing and interpreting traffic signs, recognizing surroundings, and navigating a route (Kostyniuk et al., 1997; Shua-Haim and Gross, 1996). Copilots also helped drivers to compensate for declines in reaction time and increased difficulty with divided-attention tasks. The copilot may have increased the amount of time available for making a decision by providing the driver with information earlier than would be available without the copilot. The copilot also served as a second conduit of information, reducing the need for the driver to engage in divided-attention tasks (Kostyniuk et al., 1997).

Perceptions of Risk and Self-Bias

Self-restriction by older drivers does not seem to be a deliberate action on the part of older drivers to reduce their risk of crash, but rather a choice that is consistent with their lifestyles and comfort levels. For example, older drivers have stated that they did not drive at night because they did not need to drive at night (Benekohal et al., 1994, Kostyniuk et. al., 1997) and that flexibility in schedules, due to being retired, allowed them to choose to avoid peak traffic periods (Lerner et al., 1990, Kostyniuk et al., 1997). Benekohal et al. (1994) noted that although older drivers were aware of some changes

in their abilities, they appeared to have adapted their driving activities without conscious thought or awareness. In a study that estimated the safety effects of compensatory changes of older drivers on fatal crashes, Hakamies-Blomqvist (1994) argued that older drivers implement driving adaptations such as driving more slowly, reducing distractions, and eliminating variance from the choice of routes, to reduce the mental load of the driving task. She points out that increased safety may not be the conscious goal of compensation, only its by-product.

Research into risk perception indicates that older people perceive themselves to be at risk on the roads (Holland and Rabbitt, 1992), but do not have well-defined perceptions of the possible sources of the risk (Holland and Rabbitt, 1994). In a study that examined the perceptions of driving risk among older drivers, Holland and Rabbitt (1994) asked a sample of 641 drivers over age 50 to rank risky driving situations. Drivers in the 70s and 80s seemed as aware as drivers in their 50s of what generally constituted a risky situation, but did not seem aware that some driving scenarios, such as complex intersections, that are not generally viewed as dangerous, have become specifically risky for them, as evidenced by the disproportionate number of their crashes at such locations.

Studies of self-bias and perceptions of driving risk have found that older drivers, similar to drivers from other age groups, have a self-bias about their driving abilities and tend to perceive their own chances of having a road crash to be lower than those of their peers (Matthews, 1986; Holland, 1993). They also perceive their own skills to be greater than those of their peers (Matthews, 1986; Holland, 1993). Matthews (1986) found that male drivers aged 65-75 saw the risks of a crash as being a problem for their peers, but not for themselves. Furthermore, they believed that even if the situation were to demand quick reflexes, they had the skill to avoid crashes. However, they did not believe that such skills were possessed by their peers. Matthews stated that there appears to be a dissociation between the objective risk and the perceived risk, together

with overconfidence in the ability to handle a driving situation with crash potential. He found that this effect was more evident in men than in women.

Holland (1993) found a decline with age in confidence in one's own driving abilities when comparing oneself with younger groups. This decline was very evident when rating the ability to handle "uncontrollable" and "controllable" driving situations. While drivers in their 70s were confident of their own abilities to drive in "controllable" situations, they felt that they were less able than younger drivers to handle driving in "uncontrollable" situations. At the same time, they believed that they were better able to handle driving in an "uncontrollable" situation than others their own age. It appears that, with age, older drivers become less confident in their own abilities, especially when compared with younger drivers. Their positive self-bias declines, but is still very much evident.

6. THE DECISION TO STOP DRIVING

Driving cessation usually follows an accruement of self-restrictions of driving activity brought about by the accumulation of an older driver's physical and cognitive changes. Health problems, feelings of nervousness and anxiety while driving, the expense of maintaining and insuring the vehicle, availability of other means of getting around, and the influence of family, friends, and physicians form a consistent set of the reasons given by people to stop driving (Hopkin, Robson and Town, 1987; Johnson, 1995; Persson, 1993; Simms, 1993).

Table 1 lists the factors most often mentioned in Persson's focus group study of former drivers (1993) as having contributed to the driving cessation decision. Persson noted that this study population was a healthy group that attained higher-than-average education levels, therefore the ranking may reflect these characteristics.

Table 1. Reasons given for stopping driving*
Advice from physician
Increased nervousness while driving
Trouble seeing pedestrians and cars
Medical conditions
Advice from family and/or friends
Difficulty coordinating hand/foot movement
Transportation provided by retirement center
Cost of upkeep/age of vehicle
Involvement in minor crashes
License revoked

* Adapted from Persson (1993).

Health Reasons

Many studies of driving cessation have identified poor health as the primary factor associated with driving cessation (e.g., Carr, 1993; Forrest et al., 1997; Gianturco et al., 1974; Kington et al., 1994). Johnson (1995) found health problems were a key factor for driving cessation in her sample of 75 community-dwelling older residents in a rural area. A study based on reports of driving habits of over 2,400 persons over age 50 found that general health problems, other than eyesight or hearing impairment, accounted for 30 percent of driving cessation decisions (Kington et al., 1995). Six medical conditions explained 50 percent of the cessation decisions in a study of 276 community-based ambulatory individuals, age 70-96 (Campbell, Bush, and Hale, 1993). These conditions were, macular degeneration, retinal hemorrhage, limitations in activities of daily living (ADL) (such as bathing, dressing, and toiletting), Parkinson's

disease, syncope (loss of consciousness), and residual paralysis or weakness after stroke.

In the Campbell et al. study (1993), ADL deficits were associated with the decision to stop driving for 25 percent of former drivers in the sample. Nevertheless, in the same study, 42 percent of the people who had two or more of these six conditions reported still driving. It should be noted that this study was conducted in Florida, where there is a legislative constraint against driving for 12 months after a syncopal episode. This law encourages driving termination among older people and may make Florida unrepresentative of other areas of the U.S. Those who had syncope 5 years earlier were just as likely to have stopped driving as those with recent blackouts. Still, only 35 percent of patients who had experienced syncope gave up driving.

Using focus groups to explore the driving cessation decisions of 56 older adults living in retirement communities, Persson (1993) found that the most common pattern of driving cessation followed a gradual build-up of self-restriction in driving, i.e., not driving at night or in heavy or fast traffic, decreased miles driven, decreased enjoyment of driving, reluctance to drive others, particularly grandchildren, and copiloting. Driving cessation finally was precipitated by the occurrence of an event such as getting lost, a minor crash, an increase in health problems, or moving to a retirement community that provided transportation. The move to the retirement community was the most common triggering event for driving cessation in the study sample. The second, and less common pattern of driving cessation in this sample, was a sudden disabling event, such as a stroke, which left the person unable to drive.

A study of the driving and cessation patterns of 600 community-dwelling survivors of a cohort of persons, who were at least age 65 and driving when the cohort was established 7 years earlier, identified the primary factors associated with driving cessation as: diseases affecting neuromuscular and visual function and increased disability, or decreased activity (Marottoli, Ostfeld, Merrill, Perlman, Foley and Cooney,

1993). Factors such as retirement and decreased income were also associated with driving cessation in this study. The factors appeared to have a cumulative effect. Marottoli et al. (1993) found that when no factors were present, no drivers stopped driving; if one or two factors were present, 17 percent stopped driving; and if three or more factors were present, 49 percent stopped driving. The same study also found an inverse correlation between driving cessation and activities such as walking one-half mile, climbing stairs, performing heavy household work and participating in active sports and exercise.

A study of symptoms, diseases, and medications associated with the cessation of driving among older drivers found macular degeneration, stroke, and Parkinson's disease to be associated with driving cessation (Stewart et al., 1993). In addition, this study found that eye problems caused by general health, brief loss of vision, and hospitalization in the past year were associated with driving cessation.

Additional associations with driving cessation have been found for stroke, Parkinson's disease, arthritis, hip fracture, and deficits in ADL (Marottoli et al., 1993). Angina, diabetes, and self-reported poor vision were independently associated with driving cessation among older women (Forrest et al., 1997). This study also found an association between fractures/falls and decreased driving frequency or driving cessation, a finding which may be unique to women because osteoporosis is more common among women. In Johnson's (1995) study of driving cessation among rural, community-dwelling, former drivers over 70 years of age, associations were found between driving cessation and self-reported impaired vision, decreased hearing, and painful joints.

Heart disease impacts driving activity, as older drivers hospitalized for heart disease tend to reduce mileage before and after hospitalization (Waller, 1987). Forrest et al. (1997) found that, for women drivers, heart attacks were strongly associated with not driving on trips of more than 100 miles. These reductions in driving could be due to

changes in driving ability or fatigue, as well as changes in lifestyle-recreation and occupation-due to the disease (Waller, 1987).

Comorbidity, or the presence of several medical conditions at once, has been found to have a strong effect on driving reduction and cessation decisions. For example, the Forrest et al. (1987) found that comorbidity increased the likelihood that older female drivers would reduce or stop driving, particularly if they were over 75 years of age. Driving reduction in this study was manifested by decreased mileage, taking less trips per week, and avoidance of trips greater than 100 miles. The probability of complete driving cessation increased with each additional medical condition the person reported.

Interestingly, there are inconsistent findings about the association of certain conditions and driving cessation. Marottoli et al. (1993) found that cataracts and glaucoma were associated with driving cessation, while Campbell et al. (1993) found that diagnosis of cataracts and glaucoma were unrelated to the decision to stop driving. One reason cataracts may not consistently be associated with driving cessation is that the condition is correctable through surgery. People may reduce driving due to cataracts, but surgery may relieve their vision difficulties so that people can return to or increase driving after surgery. The correctable nature of cataracts may affect how their influence on driving reduction and cessation is perceived. Visual acuity is improved, which allows some former drivers to return to driving (Monestam and Wachtmeister, 1997). In fact, a Swedish study of the impact of cataract surgery on driving found that after surgery, 25 percent of people who did not drive before surgery were driving, and 45 percent of people who drove before surgery were driving more frequently after surgery.

Internal Factors

Beyond health issues, a myriad of other factors have been found to contribute to driving cessation. In Johnson's (1995) study of older rural community-dwelling residents, the decision to stop driving was affected by having been involved in a crash, nervousness, difficulty concentrating, and loss of confidence. Additional reasons reported in the

Kington et al. (1995) study included "not comfortable driving" and not being able to afford a car or the insurance premiums.

There is consensus among various studies that the likelihood of making the decision to stop driving increases with advancing age (e.g., Campbell et al., 1993; Kington et al., 1994; Marottoli et al., 1993; Stewart et al., 1993), and that driving cessation is more likely among women than among men (Campbell et al., 1993; Kington, 1994; Stewart et al., 1993). Men appear to be more reluctant to give up driving, which may reflect a stronger driving-dependence link if they were the principal drivers in their families (Campbell et al., 1993; Carp, 1971; TRB, 1988).

According to two studies, men and women stop driving for different reasons. Women stop driving due to loss of confidence and cost, while men quit because of vision problems, slowed responses, loss of confidence and licensing problems (Eberhard, 1996; Foley, Eberhard, Ostfeld, Wallace, and deWolf, 1990).

Campbell et al. (1993) found that although medical conditions were correlated with the decision to stop driving, when people were asked why they stopped driving, most said they "voluntarily stopped driving." Fewer people gave "health or medical problems" as the reason, and some reported no reason. Campbell and his colleagues concluded that when older drivers cited a medical justification for driving cessation, the act of doing this acknowledged a disease-related impairment. They argued that the justification of the decision to stop driving "voluntarily" was less straightforward and indicated that the person may have been in a state of denial, or may have depended less on driving, which reduced the need to justify its cessation.

Carp (1971) reported major differences in the perception of the meaning of driving cessation, depending on whether the person was or was not still driving. Former drivers had more positive recollections of the cessation experience than did drivers anticipating the loss of driving privileges. Furthermore, former drivers with the most positive

perceptions could not explain why they felt that way. Carp concluded that denial and defensive memory mechanisms were at work, because the acceptance of ex-driver status is an unpleasant and ego-threatening experience.

External Influences

Influences from external sources such as physicians, family, friends, and the department of motor vehicles, can also affect driving cessation decisions. Physicians can advise the patient that he or she should not drive. Family and friends can help a driver to make a decision about stopping driving by pointing out the risks of continuing driving and providing transportation alternatives. In extreme cases, such as repeated near crashes or an actual crash, they may take the car away. The department of motor vehicles has the ultimate power to grant or deny driving licenses to individuals.

Among Persson's sample (1993), only one-third of the subjects' physicians ever discussed driving with them. Those physicians who did were usually ophthalmologists. Contradictory statements were made about effectiveness of this physician advice. The study determined that physicians had limited influence on decisions to quit driving. However, when the investigator asked, "If anyone is going to talk to the older person about driving, who should it be?" all participants said it should be the physician. Participants seemed to agree that if their physician advised them to stop driving, and if their family agreed, they would stop driving.

Persson's (1993) study also found that family advice alone would not result in a driving cessation decision. Spouses seemed to have somewhat more influence on the cessation decision than did other family members, but overall, the participants felt that their family should not bring up this topic. Persson did not report why the physician was thought to be the best advisor or why the family was not. Overall, study participants felt that they should make their own decision to stop driving. Physician advice was the second preference for decisions, and family advice was seen as "a final recourse".

In her study of rural community-dwelling former drivers however, Johnson (1995) found mixed results on the importance of family in the driving cessation decision. Family was considered very important or important for 55 percent of her group of the former drivers. However, for 45 percent, family was unimportant or very unimportant in the driving cessation decision. Johnson also found mixed opinions about the importance of friends in driving cessation decisions. In Johnson's study 59 percent of the former drivers thought friends were very important or important in their driving decisions, while 41 percent thought they were not.

Malfetti and Winter (1991) advised family and friends of older drivers to recognize that it is older drivers who must develop the motivation to take action, and must act on their own behalf, rather than feel as if they are under the control of others. This basic tenet serves as a foundation for how to approach, persuade, and motivate the unsafe older driver to come to a safe decision, whether that decision is to sharpen skills to continue driving, curtail certain driving activities, or cease driving altogether. These authors recommended that family and friends should make the older driver feel as if decisions and changes are under their own control. As a starting point, Malfetti and Winter suggested a self-assessment of driving ability, to determine if the older driver is willing to look at performance, as well as to make the driver aware of shortcomings and the need to prepare for mobility transitions. In addition, they suggested examining the driver's medications and getting vision, medical, and physical fitness checkups. The responses to limitations uncovered by an assessment can be as varied as the limitations, but the main role friends and family can play is to be supportive resources who help drivers to reach their own conclusions and decisions.

Perceived social support has been shown to influence the decision to stop driving (Heckman and Duke, 1997; Johnson, 1995). Johnson (1995) found a significant relationship between perceived social support and the driving cessation decision in her sample of rural community-dwelling former drivers. Heckmann and Duke (1997) reported the application of social support in helping older people in mobility decisions

and transitions. The program, Driving Decisions for Seniors (DDS), was created by a group of senior volunteers in Oregon as a peer support and community resource with the goal of helping seniors to prolong mobility and independence through the means most appropriate and comfortable to them. The structured peer support group allowed older drivers to reach decisions about driving mobility and cessation themselves, but with the benefit of social support, knowledge, advice, and understanding from other older drivers. DDS has several components including a "bus tour" to help older residents learn to navigate the public transportation network in their community, and peer support meetings. The program was based on the fundamental premise that the elderly are members of a subculture, and that the most effective way to help them through life transitions is through building trust, support, and friendship with peers in their subculture. DDS followed a structure to ensure that participants' driving issues and continuing mobility needs would be met.

There is evidence that some people with dementia continue driving well after the disease onset, with an increased traffic crash risk (Friedland, Koss, Kumar, Gaine, Metzler et al., 1988; Gilley, Wilson, Bennet, Stebbins, Bernard et al., 1991; Lucas-Blaustein, Filipp, Dungan, and Tune, 1988; O'Neill, Neubauer, Boyle, Gerrard, Surmon and Wilcock, 1992). Among people with Alzheimer's disease who continued to drive, the median length of driving time was 24 months. People diagnosed with Alzheimer's disease continued to drive significantly longer than those with vascular disease and other dementias (Gilley et al., 1991). Interviews with the care givers of the patients with Alzheimer's disease or other dementias in two studies (Gilley et al., 1991; O'Neill et al., 1992) indicated that the patient's driving ability had deteriorated significantly since the disease onset. In another study (Carr, Jackson, and Alquire, 1990), 25 percent of patients with Alzheimer's disease at a geriatric assessment center who were still driving were found to need help with either dressing or bathing.

Because people with dementia eventually lose judgment capability (Cooper, Tallman, Tuokko, and Beattie, 1993; Drachman and Swearer, 1993; Gilley et al., 1991; Kazniak,

Keyl, and Albert, 1991; Waller, Trobe, Olson, Teshima, and Cook-Flannagan, 1993), the driving cessation decision for them requires greater involvement of family, physicians, and others (O'Neill et al., 1992). In O'Neill et al.'s study (1992) of drivers with dementia, the decision to stop driving was made by the patient alone in only 22 percent of cases. The remaining persons with dementia stopped driving after being influenced by family members' decision, family and patient joint decision, family doctor, memory clinic, and police, in that order.

For people with dementia, the issue of driving cessation parallels how well the person deals with the reality of deficits caused by the disease. Friedland (1997) noted that patients with Alzheimer's disease who have impaired driving performance may often deny it despite evidence such as crashes, citations, and letters from physicians. It is also possible that the patient may be aware of problems, but the care giver may deny them if the patient is needed to provide transportation. Friedland advised physicians to take into consideration the interpersonal relationships of the patient and family when evaluating and managing driving cessation decisions. For example, the spouses of male patients must recognize the need to assume more control of various family matters, including driving. If the husband has been patriarchal, making the decisions and serving as primary driver, there will be a major change in their interpersonal relationship. A review of the patient's driving history and clinical examinations can help to determine the patient's fitness to drive. Recommendations about driving should be communicated to both the patient and family during multiple visits, as well as provided in writing. Patients who continue driving should be reevaluated every 6 months, due to the progressive nature of the disease.

The reaction of a person with Alzheimer's disease to a physician's recommendations about driving depends on the person's interactions with the medical care team (Friedland, 1997). Friedland recommended that physicians have consultations with the family and patient together, as well as with both parties separately. To foster a relationship in which effective decisions can be made, medical staff should get to know

the patient as a person, create an atmosphere of emotional warmth and security and use humor. These behaviors lead to a relationship of respect, rather than control over the patient. Friedland also recommended that one message at a time be communicated to patients in a slow manner and that complex concepts should be avoided because they may create confusion. It should be recognized that although patients may not comprehend the semantic aspects of a conversation, they may understand the feeling and tone of it, and this can lead to anger and depression if the tone is perceived by them as negative.

O'Neill (1997) described a "therapeutic" approach (e.g., see Bahro, Silber and Sunderland, 1995) for helping patients with Alzheimer's disease and dementia reach conclusions about driving cessation. This approach represents a change in emphasis from mandatory reporting or license withdrawal toward a consensual approach that treats the patient as an active collaborator rather than a passive patient. The therapeutic approach explores the patient's feeling and fears about giving up driving, helping the patient to reach a psychological acceptance of driving cessation. While Friedland (1997) advised holding discussions with both the patient and the family, O'Neill (1997) recommended that physicians discuss driving cessation with the patient alone first, and then include the family if this is not successful. It should be noted that these communications and therapeutic approaches do not appear to have been evaluated for efficacy.

7. RESEARCH NEEDS

To date, studies have focused on driving reduction and cessation within specific populations of older drivers, and the findings may not be generalizable to other groups of elderly. For example, one study focusing on the cessation decision interviewed residents of retirement communities that provided transportation. This factor may have made it easier for these participants to stop driving and to feel positively about being former drivers (Persson, 1993). Persson's study population was also a highly educated group, having earned bachelor's and master's degrees in proportions well above the

national average. No mention was made of income being correspondingly higher than average, but it is very likely that it was higher. Another study looked at community-dwelling ambulatory residents in Florida who were mostly retired lower income people originally from the Northeast and North Central U.S., and who were relatively healthy (Campbell et al., 1993). Neither group of subjects is representative of the total older population in the U.S. and the results of these studies should not be applied to groups with other sociodemographic characteristics.

There is a need to examine driving reduction and cessation decisions among representative populations of older people with differing education, income, and living situation characteristics. Studies that systematically compare and contrast the driving cessation process across other dimensions that could affect driving decisions, such as suburban/urban/rural, income levels, ethnicity, social support levels, individual residence versus retirement community, married versus unmarried, could provide more insight into the process. A cross-cultural study of driving cessation could also add to the understanding of the driving cessation process.

Reluctance to cease driving even when that is the appropriate decision may be due to a lack of suitable alternatives to driving. Studies of transit use indicate that there is a reluctance among former drivers to use public transit and paratransit systems because these systems do not adequately meet their mobility needs. This reluctance may also be due to the fact that, except for a few large urban areas, public transit is usually thought of as transportation for the poor and disabled, a group with which older drivers may not wish to be identified. There is a need to examine the availability of alternative transportation options for older people and to identify the characteristics that could make these alternatives acceptable to them. In addition, more alternatives need to be developed. There have been some innovative transportation schemes developed with peer groups of older people that appear promising. Such programs need to be evaluated and their strengths and weaknesses identified.

While studies have discussed physician advice and family intervention in the driving cessation decision, no studies have been identified that systematically analyze the efficacy of these messenger approaches. Who would be the most influential messenger of advice to reduce or stop driving? What is the most effective message? How could messages appeal to the issues and concerns that may vary among individuals? While qualitative interviews and focus groups have collected anecdotal evidence of the older person's feelings about physician, family, friends and other messengers, this issue has not been studied sufficiently so as to identify an effective strategy to help drivers reach the cessation decision when appropriate or to help them to continue driving safely.

There is inconsistency in the various studies regarding the effects of the interventions of family and friends in the driving cessation process of older drivers. The involvement of other people in bringing the subject up for discussion is quite different from the involvement of other people in making the decision. Advice may be perceived by the older driver differently than making the cessation decision for them, because one implies helping the older person while the other implies taking control away from the older person. These different approaches would most certainly produce different results and reactions. The driving cessation process may have distinct stages, and advice and other interventions from external sources may be perceived differently at each stage. The stages could be a function of an individual's health, age, and the amount of compensatory driving behavior they have implemented. A study that explores the stage concept and the perceptions and effects of interventions at the various stages could also further the understanding of the cessation process.

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