



# The Hennepin County Aging Initiative

## Research highlights: Older adults' transportation and mobility

*This synopsis of published research about older adults' transportation and mobility was produced as part of Hennepin County's Aging Initiative, which was created to help the county anticipate and understand the potential effects of changing age demographics for Hennepin County as an organization, and as a geographic and economic region, and to position the county to foster healthy aging for residents and clients through effective public policy.*

*The Aging Initiative is focusing its efforts on adults age 55 and older. However, for the research highlighted in this paper, generally the term, "older adults" applied only to those aged 65 and older. All data included in this summary is national data unless otherwise noted.*

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**Mobility:** The ability of people to move easily and safely throughout the county and the region, via an integrated system of transportation – is a goal Hennepin County has for all its residents.

## Top research findings

*The following summary highlights key findings from the research about older adults' transportation and mobility. A detailed discussion of the following 10 items is included in the complete report attached to this summary.*

1. Driving equals mobility in modern America and older adults who do not drive are about three times more likely than those who do to stay home on any given day. In many communities, driving or getting a ride from someone else are the only mobility options older adults have and many express concerns about asking for rides. Given the dependence on the personal automobile, some groups of older adults who are less likely to drive – including people of color, the fastest growing segment of the older 65 population – may need additional transportation options to meet their mobility needs.
2. The car is the primary means of transportation for the vast majority of all trips taken by older adults. Walking is the second most frequent means of getting around for older adults but makes up a small minority of trips older adults take, and public transit accounts for even less. Public transportation is more frequently used in more densely populated areas, however, three-quarters of older adults live in areas too sparsely populated to support conventional public transit service.
3. There are more older adults, more older adults have driver's licenses and they are driving, on average, more miles each year than previous generations of older adults. Even with relatively low, and falling, crash rates for most groups of older adults, demographic trends will drive an increase in the number of crashes they are involved in.
4. Declining vision, decreased flexibility, longer reaction times, and a decreased ability to focus or divide attention are all changes that can occur as people age that may affect their ability to drive and therefore their mobility. In addition, certain medical conditions more likely to come about in one's later years – such as Diabetes, Arthritis and, most specifically, Dementia/Alzheimer's Disease – and the medications use to treat them can affect older adults' driving ability. To compensate for these physical changes, many older adults modify their driving behavior.
5. Older drivers are over-represented in intersection and multiple vehicle crashes. Certain aspects of current road design pose particular

problems for older adult drivers. There are design and engineering best practices that can better meet the needs of older adult drivers and the U.S. Department of Transportation has developed a guide describing how to use them.

6. About one in five adults age 65 and older do not drive and nationwide each year, more than 600,000 persons age 70 and older stop driving. The decision to stop driving is difficult and many studies have found that it negatively affects older adults' psychological outlook and quality of life. Planning for mobility without driving needs to start early, especially since men will need to rely on alternative sources of transportation for about seven years and women will need the same for approximately 10 years after they stop driving.
7. Despite being more cautious pedestrians than other age groups, older adults are twice as likely to be killed as pedestrians as members of the population as a whole. Re-evaluating standard crossing intervals, improving pedestrian access to desired destinations, and addressing problems in the pedestrian environment are vital to ensuring older adults can safely walk to their desired destinations.
8. Even though the Americans with Disabilities Act requires public transit operators to provide demand-responsive paratransit services to people with serious disabilities, for a number of reasons, ADA paratransit is not, and will not be, a reliable source of transportation for the majority of older adults.
9. Taxis are available in most communities but cost limits their usefulness as a mobility option for many older adults. Hundreds of community and supplemental transportation programs exist to serve older adults nationwide but there is a lack of good data about who uses the services and how often among older adults overall, and their effectiveness as a mobility option.
10. Nationally, almost half of all state transportation workers will be eligible to retire over the next decade. As the transportation workforce ages, agencies will need to develop ways to capture the knowledge of retiring workers and ensure the health and wellness of older workers who choose to continue working.

Safe mobility makes it possible for people to live independently and accomplish basic, household-sustaining tasks. It allows people to be active members of their community and engage in the civic and social interactions that foster a sense of connectedness, adding to our quality of life, health and psychological well-being.<sup>1</sup>

Transportation has long been recognized as an issue for older adults. The first White House Council on Aging in 1971 reported that transportation was one of the three greatest needs of older people. In 1988, a conference convened by the National Academy of Sciences to investigate problems which inhibit the safety and mobility of older people found that there were insufficient transportation resources for those unable or unwilling to drive. In 1999, another national conference found that mobility gains among older

adults had been significant, but only for those who could drive and only for as long as they could do so.<sup>2</sup> At the most recent White House Conference on Aging in 2005, 1,200 delegates were asked to name 50 top policy priorities. Assuring availability of transportation options for older adults was voted number three among 50 resolutions, ahead of those addressing Medicare and Medicaid.<sup>3</sup>

## Driving = Mobility in modern America

In America, personal mobility is tied to the motor vehicle.<sup>4</sup> One study that examined 2001 National Household Travel Survey data found that more than half, 54 percent, of non-drivers aged 65 and older stay home on any given day, compared with just 17 percent of older drivers. While older adult non-drivers make 15 percent fewer trips to the doctor than drivers, they also make 65 percent fewer trips for social, family and religious purposes, and less than half as many shopping trips and trips to restaurants and other places to eat than drivers their same age.<sup>5</sup>

Although some older adults' mobility may be hampered due to illness or disability, for many older adults the only alternative to driving oneself is to get a ride from someone else. In a 2002 survey of adults age 50 and older, about half of respondents said they were uncomfortable asking for rides because of "feelings of dependency" and "concerns about imposing on others."<sup>6</sup>

Driving or getting a ride in an automobile may be the only transportation options available in the communities where

many older adults live. More than three-fourths of the older population lives in the suburbs and rural areas, where automobiles are the primary mode of transportation.<sup>7</sup> Most older adults continue to live in the same homes or localities where they lived before they retired, close to family and friends, and in familiar surroundings.<sup>8</sup>

### Driving differences by race and ethnicity

Persons of color make up the fastest-growing segment of the over-65 population. About one in seven older adults was a person of color in 1994 and this number is expected to more than double in the next few decades.<sup>9</sup>

Even though most older adults drive to meet their mobility needs, older people of color are less likely to drive and more likely to live in households without cars. While 16 percent of white persons age 65 and older do not drive, 42 percent of older African-Americans, 39 percent of older Latinos, and 45 percent of older Asian-Americans do not drive. In addition, 28 percent of older African-Americans, 19 percent of older Latinos, and 9 percent of older Asian-Americans live in households with no cars.<sup>10</sup> Other groups of older adults who are also less likely to drive include those living in the central city, older women (particularly over age 75), the poor, and those living alone.<sup>11</sup>

Given the importance of driving to mobility in today's America, different rates of driving mean people of color, much like older non-drivers overall, are more likely to stay home on any given day. More than a third of older Latinos (34 percent),

African-Americans (36 percent), and Asian Americans (38 percent) stay home on any given day, compared with 22 percent of older white adults.<sup>12</sup>

At the same time, older African-Americans, Latinos and Asians are more likely to occasionally use public transportation than older whites. While 10 percent of older white adults use public transit occasionally, 21 percent of African-American and Latino older adults, and 16 percent of Asian-American older adults use public transportation at least occasionally.<sup>13</sup>

## Travel mode

### By car

Although there is some variation from rural to suburban to urban regions, overall people age 65 and older make about 90 percent of their trips by car, more than 65 percent as drivers and another 22 percent as passengers in a vehicle.<sup>14</sup> Even those over age 85 make 80 percent of their trips by car, driving half the time.<sup>15</sup> In 2001, older people made a greater percentage of their trips as drivers than did people between the ages of 25 and 64.<sup>16</sup>

Getting around by car is also important for older adults who do not drive. Non-drivers over the age of 65 made almost as high a percentage of their total trips in a car as did drivers of that age. Older adults who do not drive are frequently dependent on others for rides, often on other older drivers.<sup>17</sup> For this reason, one older person losing a license or their ability to drive may substantially reduce the mobility of several older individuals.<sup>18</sup>

The personal car is also the preferred means of transportation

among older adults with disabilities, with about 60 percent currently driving. When asked about the type of transportation used in the past month, 55.6 percent of older adults with a disability drove and 70.5 percent rode as a passenger in a vehicle.<sup>19</sup>

**Dispelling a myth about older adults' transportation needs:** *As people age, they first lose the ability to drive; they then use public transit if it is available; when unable to use public transit they walk, and finally, unable to walk they use special transit services.*

*According to Sandra Rosenbloom (2003), "although widely believed, this 'progression' is largely wrong." Driving is often the easiest physical task for older people. Long before losing the ability to drive, older people may be unable to board or ride public transit, or walk to a bus stop or train station. Even though they may still be able to use special transit services, the majority of older adults, regardless of disability status, are able to ride in a car and prefer to do so.*

*The Brookings Institution, Center on Urban and Metropolitan Policy. (2003, July). The Mobility Needs of Older Americans: Implications for Transportation Reauthorization (Transportation Reform Series). Washington, DC: Sandra Rosenbloom.*

### On foot or by bicycle

Walking is the second most frequent means of getting around for older adults, however, it is their chosen travel mode for a small minority of trips and only a small percentage of older adults choose to walk to destinations. Although more than half of older Americans make walking a regular recreational activity, and nearly two-thirds walk a half mile at least once a month, various studies peg the

percentage of all trips made on foot by those over age 65 at somewhere between 4 and 9 percent.<sup>20</sup> One study found that people 65 and over make just 8 percent of their trips by either foot or bicycle.<sup>21</sup> Just 4 percent of older Americans ride a bicycle at least once a week.

The incidence of walking varies depending on location, population density, and driving status. One study comparing the percentage of older adults who make any walking trips found that, in the United States, only 6 percent of adults age 65 and older made any trips by foot, compared to about half of adults age 75 and older in Holland and Germany. Rates of walking among older adults in some European countries have been found to range from 30 to 50 percent.<sup>22</sup> In the United States, one study found that adults over the age of 75 living in higher density, mixed-use environments – those with densities of 10,000 persons per acre or more – accomplish 20 percent of their total trips by walking.<sup>23</sup> Among older adults who don't drive, walking accounts for almost one out of every four trips, and its importance increases with age.<sup>24</sup> Another study found that about one in three, or 35 percent, of older non-drivers living in the most densely populated neighborhoods walk somewhere on a given day, while just 8 percent, or 1 in 13, of those who live in the most sprawling or rural neighborhoods do.<sup>25</sup>

### **By public transportation**

Older adults use public transportation infrequently. Only about 1 to 2 percent of all trips made by older adults are made by public transportation.<sup>26</sup> A 2003 study comparing 1995 and 2001 National Household Travel

Survey data found that older adults' public transit use had declined from 2.2 percent of all trips in 1995 to 1.3 percent of all trips in 2001.<sup>27</sup> A 2005 study found that about 12 percent of older adults overall report using public transportation within the past year,<sup>28</sup> while another study found that one in 10 older adults uses public transportation at least once a month.<sup>29</sup>

Whether or not an older adult uses public transit, or has it available for their use, is related to where they live. While transit is used for about 1 to 2 percent of total trips taken by adults over the age of 65, it accounts for between 9 and 12 percent of their travel in areas where the population density is 10,000 persons per square mile, or about eight housing units per acre.<sup>30</sup> Many older adults living in urban areas use public transportation regularly, accounting for an estimated 310 million total transit trips each year.<sup>31</sup>

However, many older Americans live in areas where public transportation service is not available. A 2004 study found that 75 percent of older adults live in areas where developmental densities are too low to support conventional public transit services, and a 2002 study found that a third of older adults live in areas where there is no transit service available.<sup>32</sup> During the 1997 American Association of Retired Persons (AARP) Community Transportation Survey, half of adults over the age of 75 reported that they did not have a bus or transit stop of any kind within walking distance of where they lived,<sup>33</sup> and two national studies completed in 2005 and 2006 found that over a third of American households do not have public bus service within two miles of their homes.<sup>34</sup> During the 2001

American Housing Survey, a little less than half, 49 percent, of all Americans reported that they have public transportation service available.<sup>35</sup>

Even if public transportation is available, there is no guarantee that older adults will be able, or want to, use the service. Some of the same declines in functional abilities that lead to problems with driving can also discourage the use of public transportation. In a 2005 study, one in six people over the age of 75 reported that they have a medical condition that limits the use of public transportation. Older adults may have difficulty walking to the bus stop, waiting for the bus to arrive, climbing aboard, standing – if no seats are available – and knowing when to get off at their stop.<sup>36</sup>

Several studies have found that older adults do not find that public transportation meets their mobility needs. Even if physically accessible, studies consistently show that older adults have a variety of safety, personal security, flexibility, reliability, and comfort concerns about public transit.<sup>37</sup> In addition, older adults often do not find the actual routes and hours of transit service to match their travel needs.<sup>38</sup>

Several researchers have suggested ways to improve public transportation to better meet the needs of older adults including:<sup>39</sup>

- Improving schedule reliability,
- Expanding hours of operation,
- Educating bus drivers to make them more responsive to older passenger needs,
- Establishing training programs for older adults not accustomed to using public transit,
- Making it easier for older adults to enter and exit buses

by reducing physical barriers such as steps and operating low-floor vehicles, and

- Making sure there are shelters and benches at all bus stops.

However, funding might not be available to make the improvements in public transportation needed to meet the mobility needs of older adults. In 2002, the U.S. Department of Transportation estimated that maintaining the current public transportation system requires an annual capital investment of \$14.8 billion, an increase of 30 percent over current levels from all funding sources. The cost of improving public transportation service has been estimated at \$43.9 billion annually, more than double the current funding level. At the same time, federal funding for public transportation has increased an average of 2.1 percent annually since 2001.<sup>40</sup>

## Driver's license holding

The percentage of older Americans who have driver's licenses is high and increasing. About 80 percent of adults age 65 and over are licensed to drive.<sup>41</sup> Even though an older adult has a license does not necessarily mean they are driving. Older adults may hold a valid license and not drive.<sup>42</sup>

According to the National Highway Traffic and Safety Administration, there were 31 million licensed drivers age 65 and older in 2007 – a 19 percent increase from 1997. The number of licensed drivers overall increased by just 13 percent during that same time period.<sup>43</sup> By 2030, older drivers will account for as many as one of four U.S. drivers and substantially more

in many rural and retirement communities.<sup>44</sup>

Licensure rates for women are now approaching those of men. About 95 percent of men between the ages of 65 and 69 years had a driver's license in 2006, along with more than 90 percent of men over the age of 70. Between 1993 and 2006, the percentage of women age 65-69 licensed to drive increased 8 percent to almost 85 percent. Licensure among women age 70 and older grew even faster, by 22 percent during the same time period to nearly 80 percent.<sup>45</sup> By 2030, the gap in licensure between women and men is expected to narrow considerably because 94 percent of women age 45-49 are currently licensed to drive.<sup>46</sup>

## Annual driving distances

Not only are there more older drivers, they are driving more miles, on average, each year. In 2001, male drivers age 65 and older averaged about 10,000 miles of driving per year, an increase of 74 percent over the last three decades. Older female drivers averaged about 5,000 miles per year, a 31 percent increase over the same time period.<sup>47</sup> In addition, compared to 1990, the average number of daily trips per person for people age 65 and older increased from 2.4 in 1990 to 3.4 in 2001.<sup>48</sup>

Data from the 2001 National Household Travel Survey compared to the National Personal Transportation Survey of 1995 indicates that older adults are increasing the amount they drive more than other age groups. Between 1995 and 2001, there was over a 14 percent increase in miles traveled by those between the ages of 65-74 and a 19 percent increase for those over age 75. Those under age 65 increased 3 percent or less during the same time period.<sup>49</sup>

Even though the average number of miles traveled for older adults has risen, older people make about 22 percent fewer trips than those under age 65. According to Sandra Rosenbloom, this difference should not be taken, as it often is, as an indication of a reduction in mobility. Instead, it is more likely a reflection of an obvious difference between those younger and older than age 65 in that older, retired adults rarely, if ever, make five roundtrips to work each week. In fact, older men take as many as 23 percent more non-work trips and travel 6 percent more non-work miles than men under age 65.<sup>50</sup>

Increases in vehicle miles traveled are projected to continue as Baby Boomers reach age 65 and beyond. Forecasting increases in vehicle miles traveled between 1990 and 2020, Burkhardt, Berger, Creedon, and McGavock (as cited in Coughlin, 2009) indicate that Baby Boomer men age

**Changes in average person miles traveled in privately owned vehicles by age from 1995 to 2001/2002**

Age group	1995	2001	1995-2001 Percent change
25-44	15,780	15,856	Less than 1
45-64	14,854	15,312	3
65-74	9,796	11,312	14
75+	5,659	6,772	19

Source: Eberhard, 2008

65 and older are likely to drive 35 percent more vehicle miles per year in 2020 than those age 65 and older in 1990 – vehicle miles traveled by women are expected to increase an even greater extent, by as much as 42 percent.<sup>51</sup>

## Crash risk

When looking at crash rates per licensed driver, older adults are among the safest drivers on the road, and their crash rates have not increased considerably over the past decade.<sup>52</sup> Older drivers under age 75 have fewer crashes per licensed driver or per population<sup>53</sup> and are less likely to be involved in crashes that kill someone else.<sup>54</sup> They are also less likely to injure or kill a pedestrian.<sup>55</sup>

However, when crash rates are examined per mile driven – rather than per licensed driver – and when looking at fatalities instead of crashes or injuries, driver fatality rates are higher for drivers age 85 and older than for any other age group.<sup>56</sup> In terms of fatal crashes per mile traveled, adults aged 80 and older are roughly seven times more likely to be killed in a traffic crash than are individuals aged 25 to 70.<sup>57</sup> Compared to an overall national average of 1.44 fatalities per 100 million vehicle miles traveled, drivers over the age of 75 have a fatality rate of 3.7 deaths per 100 million vehicle miles traveled, and those age 85 and over have a fatality rate of 8.0 deaths per 100 million vehicle miles traveled.<sup>58</sup>

Older adults are also overrepresented in fatal crash data when compared with their overall share of the population. Of the roughly 40,000 annual traffic

fatalities in the United States in 2006, adults age 65 and older accounted for 17 percent of fatalities, even though they accounted for 12 percent of the total population, made fewer trips and traveled fewer miles than younger drivers.<sup>59</sup> Although there is a growing body of evidence from studies in Europe and Australia that per mile crash rates for older drivers are upwardly biased due to their tendency to travel fewer miles.<sup>60</sup>

Older drivers also appear to be at greater risk of dying after a car crash. Older bodies are more fragile than younger ones, making older adults more likely to be injured or killed in a crash.<sup>61</sup> Compared with middle-aged drivers of the same sex and involved in the same severity of crash, older drivers are three times more likely to die as a result of it.<sup>62</sup> Fatal crash rates for older adults are influenced by frailty.<sup>63</sup> This may explain why older adults are overrepresented in fatal crash statistics – not because they are necessarily more likely to crash than younger drivers, but because they are more likely to be killed in a crash and have it recorded in fatal crash statistics.<sup>64</sup>

Recent research completed by the Insurance Institute for Highway Safety indicates that fatal crash rates among older drivers are on the decline. The Institute found a 20 percent decrease in the total number of fatal crashes among drivers aged 70 and older between 1997 and 2008, and crash involvement declined more for older drivers than for younger drivers during the same time period. Fatal crash involvements of drivers ages 35-54 decreased by 7 percent, while fatal crash involvements for drivers ages

70-74, 75-79, and 80 and older declined by 21, 25 and 16 percent respectively.<sup>65</sup>

These findings contrast with previous research conducted by the Insurance Institute which predicted that by the year 2030, drivers age 65 and older will account for 16 percent of all crashes and 25 percent of all fatal crashes.<sup>66</sup> Despite these recent declines in fatal crashes among older licensed drivers, the large increase in the older adult population, coupled with the fact that more older people will be licensed drivers, live further from social services and will drive more miles than the present older generation has led some researchers to conclude that there will be an absolute increase in crash rates, even if per capita rates continue to drop.<sup>67</sup>

## Age-related conditions affecting driving

As individuals age, their ability to drive a car can be compromised as age-related declines in vision, coordination, flexibility and reaction time conspire to decrease their ability to operate an automobile.<sup>68</sup> Driving is a complicated task that requires highly-attuned visual, mental and physical abilities. Researchers are finding that it is not age alone that leads to problems with driving. Instead, it is often a combination of medical conditions, the medications used to treat them and the aging process that lessen the ability to operate an automobile. Medical conditions can emerge at any age but they are more likely to surface in later years. However, there is wide variation from individual to individual

– not all drivers will experience declines in driving-critical abilities at the same time and some may not experience them at all.<sup>69</sup>

According to the U.S. Department of Transportation Federal Highway Administration, there are several changes that can occur as people age that have the potential to affect their ability to drive:<sup>70</sup>

- *Declining vision:* Declines in visual abilities become more common with increasing age. Roadway signs, pavement markings, pedestrians and other drivers become more difficult to see, particularly at night when low lighting and glare from headlights can interfere with vision. It can also become more difficult to tell the distances between objects (spatial perception) as one grows older.
- *Decreased flexibility:* Older drivers may have difficulty turning their heads to look left and right at intersections and over their shoulders during lane changes due to decreased flexibility. Older drivers may also have trouble in situations that require quick physical movements such as abrupt turns or stops.
- *Decreased ability to focus or divide attention:* Older drivers may find it difficult to sort through the large amounts of information encountered quickly during driving situations or divide their attention among two or more driving tasks. This poses particular problems for older drivers in novel or complicated driving situations, such as when navigating new areas or construction zones.
- *Longer reaction time:* Older drivers are often slower to respond to traffic control devices and unexpected changes in traffic or road conditions.

## Behavioral adaptations

Driving patterns change as people age and many older adults make accommodations for declining abilities by modifying their driving behavior to restrict travel to the times and places they feel safest.<sup>71</sup> When compared to younger drivers, older adult drivers are more likely to avoid driving at night, in bad weather, in urban areas and on highways and during peak travel times. Some older drivers drive more slowly, drive more often with a passenger, increase seat belt use, need larger traffic gaps when merging, and avoid unprotected left turns across traffic.<sup>72</sup>

## Medical conditions<sup>73</sup>

Again, it is not an individual's age alone that decreases driving ability. Instead there are a number of medical conditions and chronic illnesses that are more likely to occur in older age. It is not the medical condition itself that raises the risk of a crash, but rather how the condition affects critical driving skills. Treated conditions, such as high blood pressure, may have no effect on driving at all. Not all medical conditions influence crash risk, and different individuals differ in the extent to which they are affected by their condition and their ability to compensate for it.

Many older individuals live with more than one medical condition or chronic illness. The combined effects of multiple conditions can compound driving issues and make it difficult to determine the effects of a specific medical condition on driving performance.

There is a wide variety of medical conditions that can affect driving ability:

*Cataracts:* Cataracts affect about one-half of adults age 80 and older. A cataract is the clouding of the normally clear lens of the eye. Cataracts affect vision by blocking some of the light entering the eye.

*Age-related macular degeneration:* Is a progressive disease that destroys light-sensitive cells in the central part of the retina, used for sharp, central vision. Age-related macular degeneration affects about 9 percent of the population age 65 and older and drivers living with the condition must engage in many behavioral adaptations to compensate for decreasing visual acuity.

*Heart Arrhythmia:* In the case of irregular heart beat, it is not the condition itself that affects driving ability but instead the use of pacemakers or implantable cardioverter-defibrillators (ICDs) to treat the illness. The electric shock delivered by the devices to restore proper heart rhythm can result in a loss of consciousness or temporary loss of movement. The incidence of loss of consciousness after shock delivery can be as high as 15 to 21 percent of those with implantable defibrillators.

*Stroke:* Strokes become more likely as a person ages with the prevalence 10 times higher for those 65 and older than for the overall population. Research shows that 30 to 42 percent of stroke survivors return to driving, often without receiving any advice about their fitness to drive.

*Diabetes:* Slightly more than 20 percent of those 60 years of age or older have Diabetes. Diabetes

causes a variety of vascular conditions that can lead to heart attacks, visual declines (diabetic retinopathy) and loss of feeling in the extremities, which can directly affect the ability to drive safely.

*Arthritis:* Half of all people age 65 and older have some form of arthritis. The stiffness and pain associated with the disease can make many driving tasks difficult including steering, cornering, reversing and using a parking brake. In one study, drivers diagnosed with arthritis were about three times as likely to be in a crash and another study found that arthritic patients treating their symptoms with non-steroidal anti-inflammatory drugs (NSAIDs) had an even higher risk of crash, suggesting commonly used treatments may also affect driving ability.

*Parkinson's disease:* The average age of onset for Parkinson's disease is 60 and the prevalence and incidence of the disease increases with age. The progression of the disease means drivers will have to stop driving at some point, but may have difficulty determining when that time has arrived.

*Dementia/Alzheimer's Disease:* Is a condition that poses particular problems for driving. The condition occurs almost exclusively in older adults and incidence estimates range from 4 to 16 percent of the older adult population, allowing for variations in how the disease is diagnosed. The disease progresses slowly. On average, symptoms first appear within eight years. However it may take as long as 25 years before the disease's symptoms become readily apparent. People in the early stages of the disease drive and studies show that up to 45 percent of all patients still drive,

often alone. Several driving problems are associated with Dementia/Alzheimer's Disease including getting lost while driving, even in familiar areas, driving consistently below the speed limit, failing to signal lane changes, failing to check blind spots before lane changes, failure to maintain lane position, running stop signs, and failure to recognize and obey traffic signs. As the disease progresses, these errors become more frequent. Although many drivers cease or restrict their driving when they experience changes in their driving ability, those with Dementia/Alzheimer's may lack the insight and reasoning ability needed to make the decision to stop driving.

## Driving and medication use<sup>74</sup>

Medications can affect an individual's ability to operate an automobile at any age, but older adults may be particularly affected. One U.S. study of non-institutionalized older adults found that more than 90 percent take at least one medication per week. More than 40 percent of older adults in the study were using five or more prescription medications per week and 12 percent were using 10 or more. Any medication that causes drowsiness, memory problems, dizziness, movement difficulties or visual problems can affect an individual's ability to safely operate a vehicle. In addition to being more likely to use multiple medications, older adults are more likely to experience adverse changes in the way their body metabolizes or reacts to medications. There may be misuse of medications and medications may be under-prescribed or over-prescribed for older adults. Add to that the

possibility that older adults may combine prescription medications with over-the-counter drugs and supplements. The interaction among the many different medications any one individual older adult may be taking is unknown in most cases.

## Crash types

Both conventional road design and the way older adults change their driving behavior may play a role in their overrepresentation in certain types of crashes. Several studies have found that older drivers tend to be over-involved in intersection crashes.<sup>75</sup> Intersections and interchanges can pose a problem for older drivers because of the need for rapid decision making, quick reactions, and accurate judgments of speed and distance relationships. Older drivers are particularly at risk when turning across multiple lanes of traffic on higher speed roads. More than half of all crashes involving older drivers are angle crashes, which are associated with a driver being struck by an oncoming vehicle when attempting a left turn.<sup>76</sup>

*In Designing Communities to Enhance the Safety and Mobility of Older Adults: A Universal Approach, Eric Dumbaugh (2008) focuses on how conventional design practices create safety and mobility barriers for older adults. Dumbaugh suggests employing Universal Design.*

*Universal design challenges planners and designers to eliminate the safety and mobility barriers experienced by older adults in a way that is compatible with the needs and concerns of all road users. Dumbaugh offers four strategies for addressing older adults' mobility through a Universal Design approach:*

**Strategy 1:** *Complement the arterial system with a network of lower-speed, two-lane through routes, giving older drivers a system of roads on which they are comfortable driving and which better meet their safety needs as older drivers.*

**Strategy 2:** *Enhance the connectivity of the local street network within communities, but ensure that vehicle speeds and volumes remain low. Connecting the local street network encourages walking and diffuses traffic loads across the system.*

**Strategy 3:** *Balance system capacity with opportunities for protected left turns and safe pedestrian crossings, making intersections more accommodating for both older drivers and pedestrians.*

**Strategy 4:** *Encourage household-supporting retail and services to locate in community-oriented centers, rather than in strip developments along arterials, providing older drivers access to shops and services without traveling on the arterial system and older pedestrians with places to purchase necessary household goods without driving.*

The greatest overrepresentation of intersection crashes for older drivers occurs when turning left. In two-vehicle fatal crashes involving an older driver and a younger driver, the vehicle driven by the older person was three times more likely to be the struck vehicle. In 28 percent of these crashes, the older driver was turning left – eight times more often than the younger driver.<sup>77</sup> One study found that a driver's risk of being involved in a crash involving a left turn at an intersection increased about 8 percent each year that a driver exceeded the age of 65.<sup>78</sup>

Older adults may be overrepresented in intersection crashes because older drivers tend to drive more on non-highway, local roads and these roads tend to have more intersections.<sup>79</sup> At the same time, road designs that deliver all non-local traffic onto higher speed, multi-lane thoroughfares force older drivers to travel on roadways that require turns across multiple lanes of fast-moving traffic, the exact conditions in which older adults are most likely to be involved in a crash.<sup>80</sup>

Alleviating intersection crashes is one reason for the re-introduction of roundabouts on American roads. Although older drivers have voiced concerns about negotiating roundabouts in several studies, other studies have found that roundabouts reduce the number and severity of crashes. According to Elvik (as cited in Eby, Molnar & Kartje, 2009), changing signalized intersections to roundabouts can reduce the total number of injury crashes by up to 50 percent and fatal crashes by up to 70 percent – and these safety benefits were found for all drivers.<sup>81</sup>

Older drivers are more likely to be involved in multiple-vehicle

crashes, which makes sense given their greater likelihood of involvement in intersection crashes and older drivers' tendency to avoid driving behaviors that can lead to single vehicle crashes, such as speeding.<sup>82</sup>

Older drivers are less likely to be involved in crashes associated with unsafe driving such as run off the road crashes, those involving speeding or crashes due to tailgating.<sup>83</sup> Older drivers are also less likely to be involved in alcohol or illegal drug use related crashes.<sup>84</sup>

The timing and location of fatal crashes for older drivers is also different than younger drivers. Fatal crashes occur more often for older drivers during the daytime, during off-peak driving times, on dry roads, and on non-highway or local, low-speed roads. This is consistent with the way older drivers modify their driving behavior, they tend to prefer to travel in good weather, on local roads, and during less congested times.<sup>85</sup>

## Road design

Certain aspects of current road design pose particular problems for older adults. A 1992 study in Illinois and a 2002 study in the Netherlands surveyed older adults about road design elements that caused problems for them. Survey respondents reported that the following aspects of road design make driving difficult:<sup>86</sup>

- Reading street signs,
- Driving through an intersection, especially without a traffic signal,
- Finding the start of a left-turn lane,
- Making left turns at intersections, especially without traffic signals,

- Following pavement markings,
- Responding to traffic signals,
- Driving around a roundabout that has more than one lane.

Study participants also said that certain design components became more important as they age:

- Nighttime lighting at intersections,
- Pavement markings at intersections,
- Number of left-turn lanes at intersections,
- Width of roadway lanes,
- Raised concrete lane guides for turns at intersections,
- The size of traffic signals.

Academic researchers, government officials and transportation engineers recognize the need for highway design and traffic control improvements to better meet the needs of, and enhance and prolong the safe driving experience for, aging and older adults. At the federal level, the U.S. Department of Transportation Federal Highway Administration's (FHWA) dedicated research program on older road users during the 1980s and 1990s culminated in 2001 with the publication of the Highway Design Handbook for Older Drivers and Pedestrians (FHWA Pub. No: RD-01-103). The Handbook explains ways highway designers, engineers and highway safety specialists can better accommodate the needs of older road users through road design and engineering enhancements.<sup>87</sup> The Handbook is currently being updated with revisions scheduled for publication in 2011.

Because reconstructing the entire road infrastructure to meet the needs of older adults is cost prohibitive, design

improvements in the Handbook are targeted to new construction, reconstruction, regularly scheduled maintenance, and spot treatments in crash-prone areas. In general, recommended design improvements include increasing the size and brightness, or contrast, of painted markings and signs, reducing the complexity of traffic-control information, and making more extensive use of advance warning signs. Enhancements are focused on areas where crash data helps identify safety problems, and in areas and at times where it shows that the mobility of older adults is most affected: intersections, pedestrian crossings, highway work zones and at night.<sup>88</sup>

## Driving retirement

About one in five adults age 65 and older do not drive.<sup>89</sup> Each year, more than 600,000 persons aged 70 years and older nationwide stop driving and become dependent on others to meet their transportation needs.<sup>90</sup>

One nationally representative study of driving-life expectancy using data from the 1993 and 1995 Asset and Health Dynamics Among the Oldest Old survey found that drivers aged 70 to 74 years in 1993 had a driving life expectancy of about 11 years. Based on calculations of total life expectancy, this means that, on average, male drivers age 70 to 74 years will need alternative sources of transportation for about seven years and female drivers of the same age will need alternative sources of transportation for approximately 10 years after they stop driving. Among the oldest drivers in the study (those aged 85 years and older), driving life expectancy was approximately

two years, which was about one-third of the remaining life expectancy for men and about one-fourth of the remaining life expectancy for women.<sup>91</sup>

About 10 percent of the interviews in the Asset and Health Dynamics survey were conducted by proxy – that is, someone else responded to the survey questions on behalf of the older adult. Driving life expectancy researchers found that the single most important factor in predicting who would quit driving was participation by proxy in the 1993 survey. Drivers participating by proxy in the 1993 survey were 10 times more likely to quit driving over the two-year follow-up period, compared with drivers responding to the survey themselves.

Drivers reporting no vision, activities-of-daily-living (ADL), or memory problems -- or those reporting only one of these problems in 1993 but not in 1995 – were less likely to quit driving than drivers who reported one or more of these problems in 1995, but not in 1993. Drivers who reported these problems during both the 1993 and 1995 surveys had the highest odds of having ceased driving.<sup>92</sup>

Many of the reasons older adults give for stopping driving relate to health and medical problems, particularly vision and, to a lesser extent, conditions such as Parkinson's disease and stroke-related paralysis. In at least two studies, poor vision was the most commonly cited reason older adults gave for regulating or stopping driving.<sup>93</sup>

However, the relationship between medical conditions and driving cessation is not clear cut. In a survey of 1,950 adults age 55 and older in southern

California, researchers found that medical conditions were the most commonly reported reason for driving cessation. However, study participants who had stopped driving had fewer medical conditions than did participants who continued to drive. At the same time, former drivers had lower levels of self-reported health than current drivers did.<sup>94</sup>

Researchers conducting a longitudinal study of 1,466 adults age 70 and older in southern Australia found that subjective measures of health and cognitive function were more important than medical conditions for predicting driving cessation and that the most reliable health-related predictor of driving cessation was self-rated health.<sup>95</sup>

Some studies have found that older women voluntarily stop driving at younger ages and in better health than older men. Hakamies-Blomqvist and Siren (as cited in Eby, Molnar & Kartje, 2009) found that, while strongly correlated with gender, the decision to stop driving is more closely tied to personal driving history, rather than gender. In a survey of 1,494 Finnish women who had either given up or renewed their license at age 70, the researchers found that women who had quit driving were more likely to have had an inactive driving career and women who were continuing to drive were more likely to have an active driving history. In addition, women with an active driving history who had quit driving reported reasons for giving up driving similar to older men's.

Further examining these findings, Siren and Hakamies-Blomqvist (as cited in Eby, Molnar & Kartje, 2009)

determined that it is the choices that women make throughout their lives, as opposed to the aging-process solely, that affect their driving patterns. Many women have more limited driving experience than men and they often stop driving earlier than men. These differences between the sexes is likely to be less pronounced in future groups of older drivers, since both male and female Baby Boomers have grown up with the automobile, and by 2030 almost all older adults will have been licensed drivers for most of their lives. Over 90 percent of Baby-Boomer women are licensed, and if these women retain their licenses into old age at the same rate as men do now, 84 percent of women age 75 and older will be licensed by 2030.<sup>96</sup>

The process of driving cessation is mixed: some individuals stop suddenly due to a medical problem or other crisis, while others go through a gradual process that can take years or even a decade in which they become increasingly more susceptible to difficulties in traffic, limit their driving under certain conditions, and drive progressively less than before.<sup>97</sup> Drivers with dementia may be particularly at-risk to a sudden end to driving, with one study finding that for those with dementia the decision is frequently unplanned, abrupt, and involved the participation of physicians and family.

The decision to stop driving is difficult for older adults and a wide range of studies have found that reducing and stopping driving are stressful experiences that negatively affect older adults' psychological outlook and quality of life. Three studies have found that loss of driving can lead to increased

social isolation by preventing regular contact with friends and family and four studies associated driving cessation with a loss of independence, mobility and freedom. Other studies found diminished feelings of self-worth, reductions in self-esteem, and loss of identity among older adults who had quit driving. Several recent studies have found an association between stopping driving and increased depressive symptoms over time, and having a spouse to drive did not mitigate the risk of worsening depressive symptoms among older adults who no longer drove.<sup>98</sup>

Research into easing the process of driving cessation suggests that planning for mobility without driving needs to start early, before health or other crises force the issue for older adults and their families. Molnar, Eby, St. Louis, and Neumeyer (as cited in Eby, Molnar & Kartje, 2009) outlined several components of a promising approach to smoothing the transition to non-driving:<sup>99</sup>

- Program development/design based on age-related research and broader research on life transitions
- Early intervention and planning to help manage the transition,
- Involvement from a broad spectrum of professionals and family,
- Recognition that transitioning from driving to other transportation options is a unique process for each individual,
- Availability of alternative transportation options so older adults have something to which they can transition.

## Pedestrian safety

Older adults face greater safety risks as pedestrians than they do as drivers. Pedestrians are 20 times more likely to be killed on a per-mile-traveled basis than are motorists, and pedestrians older than age 65 are fully twice as likely to be killed as are members of the population as a whole.<sup>100</sup>

Although older adults made up 13 percent of the total United States population in 2003, they accounted for 21 percent of the nation's pedestrian fatalities.<sup>101</sup>

Older adults tend to be more cautious as pedestrians. As with older drivers, older pedestrians are less likely than younger pedestrians to be involved in crashes associated with risky behaviors such as improper midblock crossings. Older adults also seem to be more willing to look for protected crossing locations than other age groups – between 65 and 75 percent of all pedestrian fatalities occur at non-intersection locations, but only about 35 percent of fatal crashes involving older pedestrians take place in non-intersection areas.<sup>102</sup>

Inadequate pedestrian crossing intervals play a key role in the safety problems older adult pedestrians' experience. Standard engineering practice currently recommends timing pedestrian intervals for the average pedestrian walking speed of four feet per second, and then providing enough time for the pedestrian to reach the center of the furthest lane of traffic, rather than providing enough time for the pedestrian to fully complete the crossing and arrive at the adjacent curb. Use of a three-and-a-half feet per second crossing interval has been suggested to satisfy the

requirements of the Americans with Disabilities Act, and the most recent version of the Manual on Uniform Traffic Control Devices (MUTCD) included information about, but did not require, use of the lower crossing speed. However, even this lower crossing speed may not be adequate for older adults to cross safely.<sup>103</sup>

Two observational studies examining the intersection crossing speeds of older pedestrians found that older adults, on average, cross at speeds between 2.8 and 3.2 feet per second. While applying the 3.5 feet per second standard to a conventional 60-foot, five-lane road results in a pedestrian crossing interval that is generally sufficient for the average person using a wheelchair to enter the center of the furthest lane of traffic, it is too short for many older pedestrians. At 3.2 feet per second, the higher of the two average observed crossing values for older pedestrians, older pedestrians would travel only about 48 feet before the signal changed and they were faced with oncoming traffic. The older pedestrian must still travel an additional 12 feet, and across a now-moving lane of traffic, to complete the crossing. Again, these crossing intervals are based on averages. Older pedestrians traveling at below average speeds will find themselves having to travel even further across traffic to reach the other side of the street. Further compounding matters, a survey of signal timing practices found that 85 percent of municipalities apply the Manual on Uniform Traffic Control Devices standard crossing value of four feet per second, without completing location-specific studies to determine an appropriate interval.<sup>104</sup>

## Reasons for not walking

For many older adults, walking isn't easy. Among older adults who are no longer able to drive, declines in functional abilities may also mean they are unable to walk any distance for the same reasons.<sup>105</sup>

The conventional rule of thumb is that most people will walk to destinations located within a quarter mile of their home. The quarter-mile is based on average walking speeds. The average pedestrian walking at a rate of about four feet per second can travel a quarter of a mile in about five and a half minutes. However, older adults frequently walk at slower than average speeds, especially if they have mobility-impediments such as arthritis, or use a cane or a walker. At 2.6 feet per second, the average speed an individual who uses a cane or crutch walks, the amount of time it takes to travel a quarter mile almost doubles to nine minutes. Seventeen percent of individuals aged 75-79 require an assistive device to walk, increasing to more than a third of persons aged 85 and older.<sup>106</sup>

A 2002 survey of individuals age 50 and older published by the American Association of Retired Persons (AARP) found that excessive walking distances were identified as the single greatest barrier to increased walking, with 40 percent of surveyed respondents indicating that destinations were too far to permit walking. Other major barriers mentioned include poor sidewalks (37 percent), the absence of resting places (33 percent), and dangerous intersections.<sup>107</sup>

In national studies completed by the U.S. Department of Transportation's Bureau of Transportation Statistics and Federal Highway Administration, older people with and without disabilities reported many problems in the pedestrian environment that inhibit walking including the lack of sidewalks or the lack of a system of connected sidewalks, unsafe intersection crossings, crowded sidewalks, cyclists on the sidewalk, cars parked on or obstructing the sidewalk, broken or uneven pavements, and the failure to remove leaves, ice, snow, weeds or other obstacles that can cause falls. Older pedestrians are also concerned about their security when walking.<sup>108</sup>

A study completed by the National Center for Health Statistics in 1994 found that among older adults who reported problems in "getting around outside home," over 75 percent reported that their major issue was difficulty walking. Among the small number of those who reported difficulty in using public transit because of their disability, the single most frequently cited problem was difficulty in walking.<sup>109</sup>

## Disability paratransit

The 1990 Americans with Disabilities Act (ADA) requires public transit operators receiving federal funding to provide demand-responsive services to people with serious disabilities.<sup>110</sup> Paratransit services operate on flexible routes, often using smaller vehicles than traditional public transit and provide door-through-door, door-to-door, curb-to-curb, or point-to-point transportation, depending on the operator.

Individuals using paratransit must often make a reservation for services provided between certain locations, at certain times.<sup>111</sup> Public transportation agencies can also contract with taxis to provide complementary paratransit and, in some cases, specialized transportation services are available to provide door-to-door transportation in the form of vans operated by human-service and nonprofit agencies.

ADA paratransit is not a reliable source of alternative transportation for the majority of older adults. Eligibility for ADA paratransit services is based on disability and an individual's disability must be severe enough to significantly interfere with the use of traditional public transit. Even though disabilities do increase with age, about 58 percent of older adults do not qualify for any ADA paratransit services, where they exist, because they do not have any serious physical or mental impairment. Even among the 42 percent of older people with at least one disability, many will be ineligible for paratransit service because their mobility limitations do not rise to the level of ADA eligibility.<sup>112</sup> In a study of Bureau of Transportation Statistics data, Meg Sweeney found that just 7.2 percent of older adults with disabilities report ever using paratransit services.<sup>113</sup>

ADA paratransit is only available in areas where regular public transit service is also available.<sup>114</sup> In most communities, ADA paratransit is only available within three-quarters of a mile of existing bus routes and only during regular bus route hours – the minimum requirements of the ADA. Even though many transportation researchers

suggest that one-quarter mile is a better measure of transit access for older adults, only 43 percent of older adults in suburban areas reported living within one-half mile of public transit in 1995.<sup>115</sup>

Paratransit service is costly. In 2007, the average one-way ADA paratransit trip for the 50 largest transit systems cost almost \$36. This means it cost more than \$75 to take one eligible person to and from a medical appointment.<sup>116</sup> Due to the cost, instead of expanding service and making more older adults eligible, three 2005 studies found that many transit systems have moved to restrict service and carefully limit eligibility for paratransit over the past decade.<sup>117</sup>

The federal government considers ADA paratransit a temporary alternative to conventional public transit only until all buses are fully accessible. As more transit vehicles, stops and the paths to them become accessible, transit operators will be allowed to decrease the amount of paratransit services they provide, even as the older adult population grows.<sup>118</sup>

## Private transit and supplemental or community transportation programs

Private transit services, such as taxis, are available in many communities. However, the cost of using a taxi is often a barrier to use by older adults.<sup>119</sup>

Many communities offer demand-responsive services also known as supplemental transportation (STPs) or

community transportation programs provided by non-profit organizations, faith-based groups and older adult advocacy organizations. However, U.S. Bureau of Transportation Statistics data indicates that overall, less than 3 percent of older people with disabilities report ever using the services of a community, or supplemental, transportation provider and there is a lack of good data in the research about who is provided rides, and how often among older adults overall.<sup>120</sup>

There are two types of supplemental or community transportation providers: Providers that operate large systems that may even resemble ADA paratransit services and community transportation providers who match volunteer drivers with older, or other, travelers with mobility needs.

In annual surveys from 2000 to 2005, the Beverly Foundation and the AAA Foundation for Traffic Safety documented 492 supplemental transportation programs operating throughout the United States. The organizations found that annual budgets for the services range from \$1,000 to \$9.8 million, with a median operating cost of \$58,000. Almost half, 46 percent of the programs charge fees for service, 75 percent draw on grant revenue and 23 percent use funding from federal, state or local governments for some or all of their budgets. Supplemental transportation programs often draw on a mix of funding sources for support. Thirty-three percent of the programs target rural areas, 44 percent use automobiles as their transportation vehicles and 49 percent can provide escort services. Fifty-five percent of the services used volunteer drivers. Transportation services

that use paid drivers reported that salaries generally make up 50 percent or more of their budget.<sup>121</sup>

Among the 179 volunteer-driver supplemental community transportation providers included in the survey, budgets ranged from \$1,000 to almost \$4.4 million, with a median of \$23,500. Seventy-four percent of volunteer transportation providers are in rural areas, 84 percent use the vehicles of volunteer drivers, 97 percent provide door-to-door services, and most say that drivers act as escorts. About 13 percent charge fees, while 71 percent use grants, 62 percent use rider donations, and 18 percent tap tax revenues for some or all of their funding. Of the 728 volunteer drivers surveyed, 63 percent were age 65 or older, 51 percent were college graduates, 65 percent had household incomes of \$30,000 or more, and 67 percent were married.<sup>122</sup>

## Transportation workers wanted

As the population is aging, so too is the transportation workforce. There are three issues that will need to be addressed with a growing number of older transportation workers: ensuring an adequate supply of skilled transportation workers to replace those who retire, developing systems and processes to capture the knowledge and experience of older transportation workers exiting the workforce, and managing health and wellness in an aging workforce.

The U.S. General Accounting Office has estimated that over the next decade nearly 50 percent of state transportation workers will be eligible to retire and the federal transportation

workforce may see losses in multiple areas, including critical positions such as air traffic control. In addition, transportation relies on a hearty energy sector, particularly the petroleum industry. A 2007 study conducted by the National Petroleum Council found that the majority of the nation's energy workers will be eligible to retire over the next 10 years.<sup>123</sup>

As these workers retire, they will take with them a lifetime of on-the-job knowledge and experience. Not every practice, technique, process or lesson learned is documented or taught. As the transportation workforce ages and moves to retirement, transportation agencies will need to develop the systems and processes necessary to retain the knowledge of exiting workers.

Some workers will decide to continue to work well past the age of 65. While many will be in good health, some workers may suffer complications due to medical conditions more likely to occur in later years such as Diabetes and heart disease. It addition, when injured, it may take longer for older workers to recover. An aging transportation workforce will require additional investment in overall health and well-being to ensure worker and system safety and productivity.<sup>124</sup>

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