

SAFE MOBILITY FOR SENIOR CITIZENS

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The number of licensed older people will more than double in the next 25 years in the United States. There is a need to focus on ways of ensuring the safety of all road users without unduly restricting the mobility of older drivers. At present, it is extremely difficult to identify older driver groups who pose an undue risk to others and to assess their driving capabilities.

Older drivers as a group are not a significant risk to others based upon their number of crashes per licensed driver. However, they do have a higher crash and fatality rate per mile driven than all but the youngest (16-20) driver age groups. Driving patterns and crash involvement of the elderly are reviewed, with emphasis on the role of medical conditions and functional limitations. Drivers who understand their own limitations tend to change their behavior to accommodate declining capabilities.

Those unaware of limitations tend not to take corrective action, placing them at higher risk of crashes. Those who stop driving travel much less, are less satisfied in reaching their mobility needs and are more likely to be depressed. Research is under way to differentiate groups who are at higher risk and to develop ways to identify and assess their performance.

Key words: Older drivers, Driver licensing, Assessment, Training and improvement, Medical conditions and medications, Safety, Mobility, Crashes and exposure

1. INTRODUCTION

Extensive interest in older driver issues started in the United States with the publication of the two volume Transportation Research Board (TRB) reports: "Transportation in an Aging Society" in 1988¹. Based upon trends in current drivers' ages in the United States, there are going to be many more drivers over 70 after the second decade of the twenty-first century (Fig. 1)². There will be a marked increase in females over 70 licensed to drive. Not only will there be more older drivers, but more of them are likely to be driving more miles than drivers today. In response to the TRB study, the National Highway Traffic Safety Administration developed a traffic safety plan for older persons in 1988 and revised it in 1993³.

Public concerns about older drivers in the United States are typically triggered by occasional but highly spectacular crashes. These crashes usually involve an older driver who inadvertently steps on the gas instead of the brake pedal, plunging the vehicle into a group of pedestrians, killing or injuring a number of them. These crashes make national headlines and television news. The media amplify suggestions that older drivers pose a problem to others and should be taken off the road. This paper examines the threat older drivers pose to others and provides an overview of the current status of traffic safety for senior drivers in the United States.

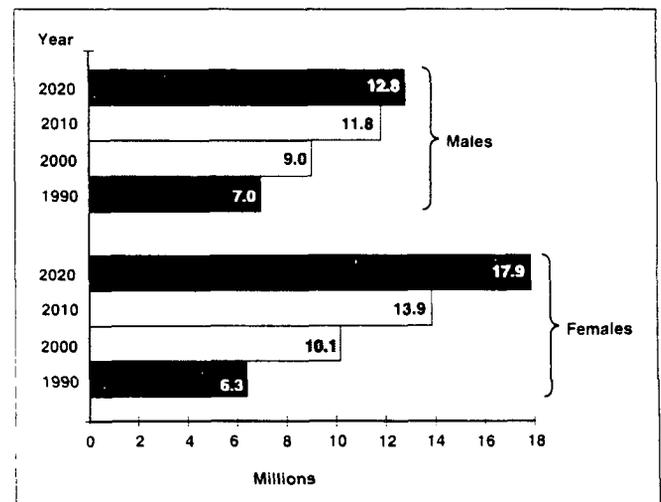


Fig. 1 Projected number of male and female licensed drivers in the United States through 2020²

2. SAFETY ISSUES

Motor vehicle injuries are the leading cause of injury-related fatalities among 65-74 year olds and the second leading cause after falls in the 75 and above age group⁴. Recent NHTSA statistics indicate that the only group to show an increase in traffic fatality rate per 100,000 population in the last ten years were those 70 or more years old

(Fig. 2). In 1994, most of the fatalities for those over 70 years of age occurred as motor vehicle occupants (4,358) than as pedestrians (1,011); males being much more likely to be killed as drivers (1,958 out of 2,356 occupants) and females slightly more likely to be killed as passengers (1,049 out of 2,002 occupants). In the ten year period from 1984 there has been over a 60% increase in older driver fatalities, a 54% increase in occupant and a 13% decrease in pedestrian fatalities, while the overall population showed a decline in fatalities in all three areas⁵. The primary reasons for these changes are increases in the age of the drivers and in their amount of driving or riding in a car⁶.

As seen in Figure 3, driver fatalities for men under 35 and women under 25 are higher than for drivers over 70, whether one uses rates per licensed drivers or population figures. In 1994, older individuals made up 13 percent of all vehicle occupant fatalities and 18 percent of all pedestrian fatalities while comprising only 8.9 percent of the U.S. resident population⁵. Furthermore, older drivers have the same or lower crash-involvement rate per licensed driver (Figure 4) or per miles driven (Figure 5) as middle age-groups. As for pedestrian fatalities, young drivers consistently kill more than three times as many pedestrians than any other age group and older drivers kill the least number⁷.

Only when vehicle miles of travel are used to determine *fatality* rates (Figure 6) do older drivers appear more involved than members of intermediate age groups. This is due, in part, to their reduction of overall mileage driven by eliminating long highway trips, leaving almost all of their miles on local roads and streets. This exposes them to more dangers-per-mile than high-mileage drivers because they encounter disproportionately more intersections, congestion, confusing visual environments, signs and signals⁸. Urban roads have a higher information load and require the driver to process more information and make faster decisions than do freeway driving situations.

Also contributing to increased fatalities of older drivers is the increasing frailty of older individuals. In fatal crashes involving an older driver and a younger driver, the vehicle driven by the older driver was 3.6 times as likely to be the one that was struck. Furthermore a driver who is over 80 is approximately 4 times more likely to die than a 20 year old in a crash of similar intensity because of his or her *relative frailness*⁹. These statistics, however, indicate occupant packaging and trauma care problems, not driver safety performance problems.

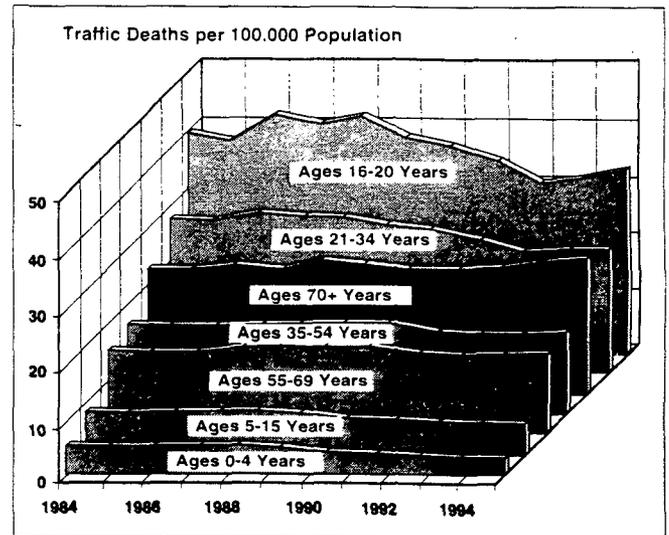


Fig. 2 Motor vehicle traffic fatality rates by age group, 1984-1994⁵

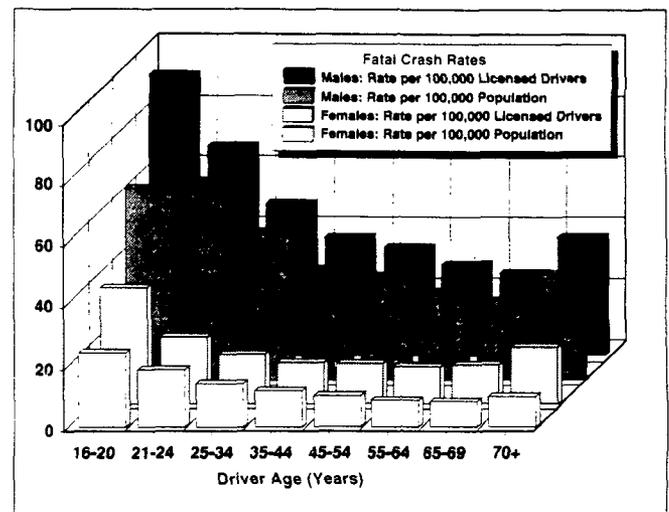
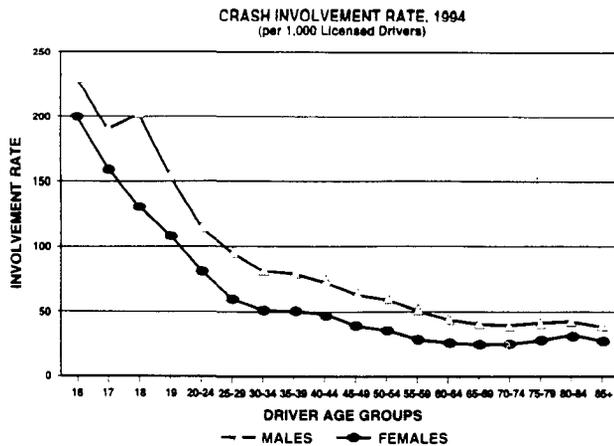


Fig. 3 Driver involvement rates in fatal crashes by age and sex⁵

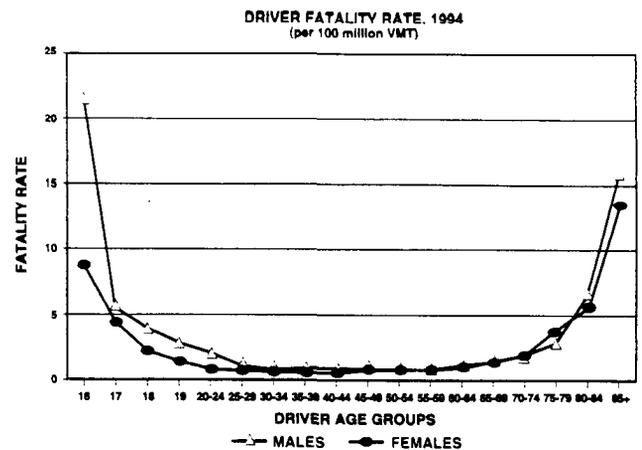
Statistics indicate that most older driver crashes occur during the day from mid-morning to mid-afternoon (10:00 AM to 4:00 PM) under preferred conditions -- clear weather, non-rush hour times. Older driver crashes are most often associated with failing to yield to traffic when merging, not responding properly to stop signs and traffic lights, or making unsafe turns.

Behaviors that lead to older people's crashes seem



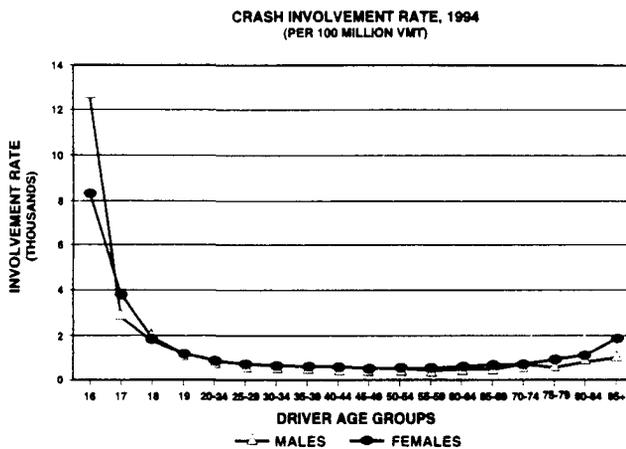
Source: Crash Data and Rates for Age-Sex Groups of Drivers, 1994 (NHTSA Research Note, October 1995)

Fig. 4 Crash involvement rate per 1,000 licensed drivers for males and females in the United States in 1994 for different age groups⁴³



Source: Crash Data and Rates for Age-Sex Groups of Drivers, 1994 (NHTSA Research Note, October 1995)

Fig. 6 Driver fatality rate per 100 million vehicle miles traveled for males and females in the United States in 1994 for different age groups⁴³



Source: Crash Data and Rates for Age-Sex Groups of Drivers, 1994 (NHTSA Research Note, October 1995)

Fig. 5 Crash involvement rate per 100 million vehicle miles traveled for males and females in the United States in 1994 for different age groups⁴³

more related to inattention or slowed perception and response than to deliberate unsafe actions that are more common to younger drivers, such as speeding, drinking and driving, and running traffic lights¹⁰.

3. DRIVING PRACTICES

Figure 7 shows that as people get older they drive less far than do younger drivers¹⁰. Older drivers are likely to be retired, so they can largely choose when to drive to the grocery store, the senior center, the doctor's office, or their children's or friends' houses. If they don't feel well or the weather is bad, they can usually put off the trip for another day.

Despite this decline in driving miles, most older people (as well as people in every age grouping) rely heavily on private vehicles for their transportation needs (Table 1). Dependence on these vehicles has increased over the past 20 years, while walking has decreased significantly, being roughly half of what it was in the 1970s. Public transportation, on the other hand, accounts for less than 3% of trips.

As drivers age they become more conservative in driving habits¹¹. Men drive less at night, less on highways, almost never on unfamiliar roads. Men over 85 years old do no long-distance driving, and only a third drive after dark. Women echo these changes, only more so. They drive infrequently in unfamiliar areas and almost never on long trips. Night driving declines--in fact, only 8% of women over 85 drive after dark.

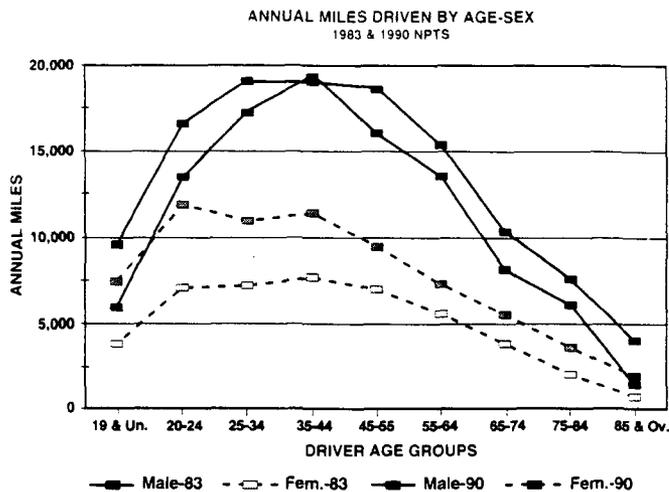


Fig. 7 Average annual miles driven in the United States in 1983 and 1990¹²

3.1 Driver licensing

There are those who say: "Let older drivers continue to drive, just not as much as before. Test them more frequently than younger drivers and *gradually take away their driving privileges.*" This concept, called a "graded license," would generally restrict older drivers to the non-rush hour times and good weather¹².

It would appear that most older drivers already adapt their driving habits to fit their declining capabilities. What remains to be determined is whether there are groups of older drivers who do not modify their driving and therefore may need the special attention of the licensing agency or the medical community.

The number of licensed drivers over 70 is expected to increase significantly over the next 25 years². The licensing numbers for women may triple in that time period. Even though there will be more licensed women drivers in their 70's and early 80's, recent survey data indicates that men in their 80's are more likely to continue driving than women (Table 2). Both men and women in the mid-eighties and beyond tend to stop driving.

Men and women give up their licenses for different reasons. Vision problems, slowed responses, loss of confidence and license difficulties are the main reasons men give for quitting. Almost a third of those over 75 have licensing problems. Women quit for somewhat different reasons. Loss of confidence was cited by women as the main reason in the one study and cost in another¹¹. Licensing problems were not the major reason women indicated that

Table 1 Percentage of older persons in urban and rural areas using different transportation modes¹²

		65-74		75-84		85+	
		1983	1990	1983	1990	1983	1990
Urban	Private Vehicle	83	90	79	85	75	77
	Public Transit	4	2	1	3	8	3
	Taxi	0	1	1	1	0	3
	Walking	11	7	17	10	18	16
	All Others	1	0	2	1	0	1
Rural	Private Vehicle	88	95	85	92	80	86
	Public Transit	0	0	0	0	0	3
	Taxi	0	0	0	1	0	2
	Walking	8	4	11	5	5	7
	All Others	1	0	2	1	0	1

Source: FHWA National Personal Transportation Survey 1983 & 1990

they stopped driving. It is important to find out more about the basis for older drivers' lack of confidence. Is this due to real or imagined incompetence, concern for personal safety (e.g., after breaking down), extensive medical conditions and frailty, or safety of others?

3.2 Mobility issues

Many people recommend that older people use a public transit system in lieu of driving. But currently, public transportation accounts for less than 3% of trips¹³. Some also recommend the use of senior transportation systems. But the evidence is that these systems are infrequently used¹⁴.

What do those who give up driving do? Studies in both rural and urban areas¹¹ show that they were much less likely to go places as often as they would like (Figure 8), particularly men over 80 years of age. Marottoli et al.¹⁵ found that there were changes in activity level and depressive symptoms before and after driving cessation. Inability to drive or ride in a car may preclude having a quality lifestyle. We need to determine the cause for this. Is it due to their declining functional abilities or due to lack of alternative transportation? If the former is true, can the drivers be rehabilitated or the vehicle adapted to permit continued driving? If the latter is true, we need to determine what should be done to provide reasonable alternatives for the missing transportation.

Table 2 Percent of men and women driving at different age groupings from eight different sources

		70-74		75-79		80-84		85+	
		Male	Female	Male	Female	Male	Female	Male	Female
Current Driver	New Haven (1)	73	43	66	22	50	11	25	4
	Iowa (2)	95	79	91	69	81	53	67	23
	Marin Co. (3)	99	93	96	89	82	69	51	20
	Sonoma (4)	95	93	94	82	88	74	65	38
	Salisbury (5)	91	72	86	60	83	51		
	Maryland (6)	93	65	84	52	84	35	53	22
	AHEAD (7)	88	70	85	60	77	44	54	22
	FHWA (8)	94	74	91	64	87	49	75	26
Former Driver	New Haven (1)	14	19	23	17	33	24	58	24
	Iowa (2)	5	10	7	13	18	24	30	43
	Marin Co. (3)	1	5	3	8	17	22	47	60
	Sonoma (4)	4	5	5	11	10	20	35	42
	Salisbury (5)	8	15	13	28	16	31		
	Maryland (6)	6	16	14	25	14	33	43	41
	AHEAD (7)	10	17	14	23	21	35	43	52
	FHWA (8)								
Never Driver	New Haven (1)	13	38	11	61	17	64	17	73
	Iowa (2)	1	11	1	18	1	23	3	34
	Marin Co. (3)	0	2	1	3	1	9	2	19
	Sonoma (4)	1	2	1	8	1	6	0	20
	Salisbury (5)	1	13	2	12	1	19		
	Maryland (6)	1	19	2	23	2	32	4	37
	AHEAD (7)	2	13	1	17	2	21	3	26
	FHWA (8)								

- Source: 1. Marottoli, R. Yale University. Yale EPESE (1996)
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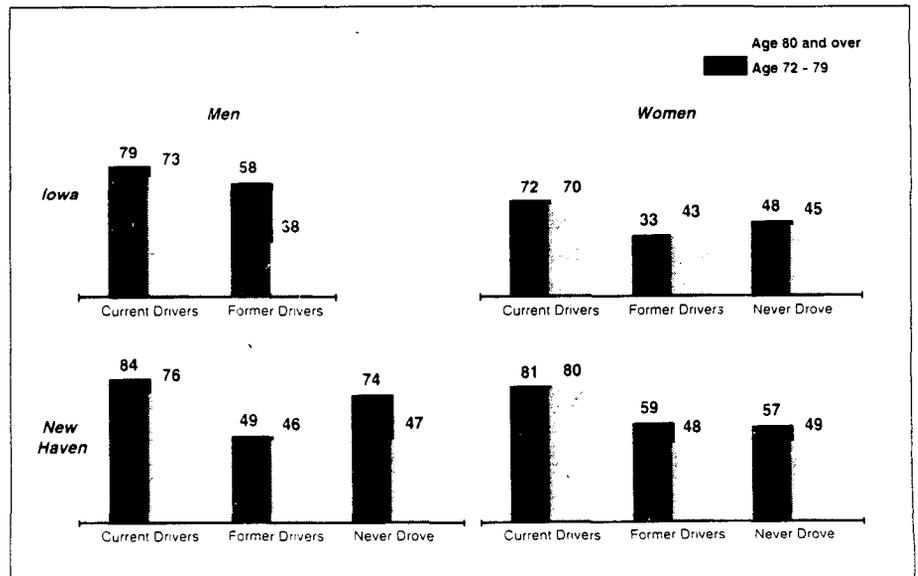


Fig. 8 Percent of older people who report that they are able to go places as often as the like¹⁰

4. MEDICAL CONDITIONS

Researchers suspect a causal relationship between medical problems and driving problems. Current research on medical conditions thought to be related to potential risk in driving focuses on alcoholism, dementia, diabetes, depression, and visual limitations. Medications used to treat the various conditions and the interaction of medications and alcohol are also of concern¹⁶.

A number of epidemiologically-oriented studies have attempted to establish how older drivers go about changing their driving behavior and their crash history^{17,18,19,20}. For the most part, the findings indicate that functional limitations are much more likely to be predictive of when individuals reduce or stop driving than they are predictive of crash involvement. Generally, as people develop more physical restrictions, they are more likely to give up driving²¹. This supports those who believe that the older person can be in charge of when he or she should or should not drive.

4.1 Dementia

Many demented people continue to drive²². Some drive for a number of years after onset of the disease. Cooper et al.²³ found that 80% of demented drivers who were involved in a crash continued to drive, and one-third had at least one more crash. They found that, compared with other older drivers, those with Alzheimer's disease (AD) were much more likely to be responsible for the crash, had more night crashes and had fewer of their crashes at intersections. These types and times of crashes provide some indication that AD drivers may lack insight into making good judgment as to when and whether to drive.

Drachman and Swearer²⁴ found that, based on caregiver reports, AD patients were 2.25 times more likely to be in a crash than age-, sex- and location-matched individuals, and less so in the first three years. Even so, the demented drivers had fewer crashes per year than younger drivers. Cooper et al.²³, using official driving records matched controls on age, sex and location, found a similar crash over-involvement rate. Waller et al.²⁵, however, indicated that there were no elevated risks for demented drivers.

Even if we were to agree that those in the early stages of dementia could drive, we do not have an adequate way to determine when they are no longer capable, nor are there methods through which they become known to the Depart-

ment of Motor Vehicles (DMV).

Most of the broader epidemiological studies using Mini Mental Status Examination or equivalent tests have not shown an increase of crash risk²³. However, Foley et al.¹⁸ did find that a free recall memory test was related to an increased risk of crashes. Several studies have shown that demented drivers lack awareness of their decline in driving competence^{22,26}. Hunt et al.²⁷ found that caregivers are not currently in a very good position to judge when those with dementia should stop driving. If this is so, we cannot expect caregivers either to report them to the DMV or control them themselves.

4.2 Sensory and perceptual impairments

Ocular diseases such as macular degeneration, cataracts, glaucoma, diabetic retinopathy, and retinitis pigmentosa could increase the risk of vehicle crashes. However, with the possible exception of glaucoma, most evidence to date²⁸ does not support such a problem. There is evidence, however, that people having cataracts¹⁹, cataract surgery¹⁷, macular degeneration²⁰, and retinal hemorrhaging²⁹ tend to stop driving.

Johnson and Keltner³⁰ found that patients with paracentral scotomas (coincident blind areas in both eyes) had twice as many crashes in a year than age-matched drivers without the visual limitation. In some of these conditions, the individual and close family members may be unaware of the problem until the driver has been involved in a motor-vehicle crash.

Research does not show any clear increased risk for those with poor central visual acuity, the type of acuity tested for driver licensure^{28,31}. However, studies by Nelson et al.³² and Levy et al.³³ showed that those states that test for central acuity did have lower fatal crash rates than states that did not.

The findings related to hearing impairment are also mixed. McCloskey et al.²⁸ found that those who owned and used a hearing aid while driving were at increased risk of having injury collisions although owning a hearing aid but not using it while driving did not. Results of Iowa findings by Foley et al.¹¹ did not support this finding.

Researchers tend to support the need for tests of higher order perceptual processes. Those with poor useful fields of view have been shown³¹ to be at much higher risk of crashes. However, other studies^{34,35} have had less success in confirming these findings. Performance on complex

traffic sign tests have been shown to be difficult for older drivers, particularly for those with dementia³⁶.

4.3 Other conditions

At present studies of medical conditions and functional limitations of older individuals are more likely to identify conditions that lead to driving cessation than to an increase risk of crashes^{19,37}. Having Parkinson's disease or a stroke was more likely to lead to cessation of driving^{17,19,20}. Having physical activity limitations^{17,19,29} and high-level functional limitations^{17,19,37} also leads to driving cessation. Interestingly, Kington et al.³⁷ found that having arthritis decreased the likelihood of driving cessation while Hu et al.¹⁷ found the opposite for males.

The findings with regards to increased risk of vehicle crashes are inconsistent with little corroboration. For example, studies of diabetes yield conflicting results, some have found an increased risk particularly for those treated with insulin or oral hypoglycemic agents³⁸ and, most significantly for those who also had coronary heart disease. Others have not corroborated these results¹⁷. There is some evidence that those with depression and lower back pain have higher risk of crashes¹⁷. Thus, the generalizations of these findings and what to tell practitioners remains to be determined.

4.4 Medications

There is some evidence that the side effects of medication may lead to an increased risk of crashes among older drivers. Leveille et al.³⁹, Ray et al.¹⁶, and Hu et al.¹⁷ found that use of anti-depressants were associated with increased risk for crashes for older drivers. Ray et al. found that benzodiazepines were associated with increased risk but neither Leveille et al. nor Hu et al. corroborated this finding. Leveille et al. found that opioid analgesics were associated with increased risk. Conversely, Sims et al.⁴⁰ recently reported that the use of a beta blocker for heart patients actually reduced the risk of crashes. Again, as in the issue of medical conditions, there are no clear guidelines for practitioners in the area of medication at this time.

5. DRIVER REGULATION

Surveys of general drivers, older drivers, physicians and

others support more frequent re-examination of older drivers. The question is whether this should be through periodic license examination of all older drivers, or after some driving or medical incident triggered a need for assessment. In the medical incident case, it is not clear whether the assessment should be through the licensing agency or private channels. Respondents indicate that the periodic license examination could be based upon the age of the driver, since they realized that many of the functional limitations that affect driving performance only begin to become prevalent in the upper sixties and seventies. The real issue is whether licensing examinations can fairly identify those people who need to have their license restricted or denied.

Recent evidence indicates that if they are aware of their deficiencies and retain their cognitive ability, older drivers seem quite able to make appropriate adjustments to their driving. However, studies indicate that older drivers who are not aware of their limitations, such as those with dementia^{24,27}, and peripheral vision difficulties³⁰, tend not to self regulate. These drivers are at higher risk and may need an external regulation system.

5.1 Self regulation

Our development program is conducting studies to determine how to best assist older people regulate their driving. Older drivers and their adult children and caregivers are becoming increasingly aware of the need for driver assessment. Generally, however, they do not know where to obtain help. Occupational therapists have indicated that they are beginning to see more clients who come for driver assessment based upon family concerns.

A clearer idea is needed about how older drivers go about regulating their own driving. Research into how older drivers, notably those with functional limitations, perform the tasks associated with difficult activities such as intersection negotiation in familiar and unfamiliar areas is underway. This will provide the information needed to determine if there are groups of older people who need guidance (regulation) that a graded license could provide.

If further research confirms that certain older drivers with medical problems do not take themselves off the road, then a way to control these riskier older drivers may be to provide guidelines to the individual or his/her family or physician. The guidelines would enable the functionally disabled driver or their caregiver or physician to judge the conditions under which they should or should not drive.

5.2 Driver licensing

Generally, almost every state and Canadian province brings drivers in for re-evaluation for some cause. The causes are an adverse traffic record, a physician report, a police officer referral after a crash or citation, or a family or friend referral. The system needs to be improved to help ensure that as many problem older drivers as possible are detected before becoming involved in a crash.

The American Association of Motor Vehicle Administrators (AAMVA) has developed a guideline⁴¹ for older drivers and presents a graded license system. This would systematically reduce when and where an individual could drive, based on his or her capability. Unfortunately the procedures to access and assess drivers who would be subject to the graded license are not available.

There is concern about the extent to which current or proposed licensing procedures can identify those with driving problems. For example, most of the research indicates that the simple visual measures typically used in licensing examinations do not relate to crash involvement⁴². The serious visual problems, such as blind areas in both eyes and glaucoma, cannot be detected by tests now being used in DMVs.

Whether licensing officials can detect older problem drivers through the driver re-examination process is unclear. Lower fatal crash rates were found in states with periodic vision testing compared to states not requiring such tests^{33,32}. Comparing per-driver crash rates of states with age-based license renewal testing against neighboring states without such testing did not show a reduction in culpable crashes⁴³. Thus, since renewal testing seemed to have more influence in inducing individuals to drive less, safe older drivers may be needlessly stopping driving, reducing their mobility as a result.

While many of the problems of older drivers appear to be related to inattention, we currently have no practical test for driver inattention. Research indicates that the problems of older drivers are far more complex than that which can be measured by simple, short-time-frame tests. Yet, the practicality of examining thousands of people necessitates simple inexpensive measures.

6. MOBILITY NEEDS

If there is a need to deny the older driver the ability

to drive, or restrict when they drive, then society must also be ready to assist them to maintain their lifestyle. The mobility consequences of reducing or stopping driving are being studied to determine the transportation needs of those who must stop. From the results of this study the needs for maintaining the mobility of those who reduce their driving should be identified. Thus, society removing someone's license can more appropriately be done by giving them alternatives.

7. CONCLUDING REMARKS

Although older drivers as a whole are not a significant risk to others there are sub-groups that do pose an undue risk. Before we can make recommendations to the states on restricting or denying these riskier older drivers we need procedures that identify them and fairly assess their problems. We must rigorously evaluate these systems to insure that safe drivers are not needlessly denied their mobility.

Licensing agencies are being pressured to re-examine older drivers. The public needs to be told that, as a group, older drivers are causing far fewer crashes and are killing far fewer pedestrians than other age groups. They need to understand that older drivers are frail and, when involved in a crash, are more likely themselves to be seriously injured or killed.

As research provides supporting evidence, the general public, health care professionals, police, and licensing agencies need to be told how they can help identify those older drivers who are at a higher risk and help in their regulation.

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