Driver and Pedestrian Training

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This paper provides a discussion of current efforts to train older drivers and pedestrians, identifies ways of improving training and the best prospects for change, and outlines needs for further research.

RELEVANCE OF DRIVER AND PEDESTRIAN RETRAINING

Magnitude of the Problem

Older drivers and pedestrians face accident risks that differ substantially from those of their younger counterparts.

The Driving Problem

The nature and magnitude of losses in physical and mental functioning that make driving more difficult and less safe for drivers of advanced years have been well and completely described in other papers in this volume. Because they tend to drive less than their younger counterparts, older drivers have fewer accidents as a group *(1)* and on an individual per-driver basis *(2–5)*. However, they have more accidents on a per-mile basis *(6)* and their fatal accident rate, both on a per-driver and per-mile basis, greatly exceeds that of other age groups except teenagers *(7, 8)*. Moreover, older drivers tend to be more often responsible for those accidents in which they are involved *(9, 2)*. Last, they are more likely to be injured or killed in any given accident than younger drivers *(10, 11)*.

The solution often advanced—getting older drivers "off the road"—overlooks the extent to which older drivers already limit their exposure by driving less often and under less hazardous circumstances *(12–14)*. It also overlooks the enormous dependence of older drivers on an automobile as a means of maintaining independent mobility.

The Pedestrian Problem

On a per-individual basis, pedestrians over age 75 have over twice the pedestrian fatality rate of any other age group *(15)*. A major contributor to older-pedestrian fatalities is the greater vulnerability of the older accident victim to injury or death. Compared with children in the 5- to 14-year age group, a pedestrian 65 to 74 years old is four times more likely to die if struck by an automobile; those in the 75-plus age group are six times as likely to die. According to Evans *(16)*, increased susceptibility begins at about age 20, increases steadily to about age 80, and then accelerates. Men are at greater risk than women throughout the age span and the difference increases sharply after age 75 *(17, 18)*. However, elderly pedestrians appear to be at no greater risk of having an accident than are adults of other ages *(19, 17)*.

It is of interest to note that the fatality rate for pedestrians over age 64 in the United States has declined by 32.5 percent during the decade 1975–1984, whereas that for ages up to 64 has remained unchanged *(20)*. To what extent this reduction is due to a reduction in pedestrian travel within this age group as compared with changes in the characteristics of the highways and population itself (e.g., greater fitness) cannot be determined from available data. However, it is apparent that the involvement of older people in pedestrian accidents has been declining.

The Role of Training

Although safer cars and highways can help bring down the accident rate among older drivers and pedestrians, as such improvements have for other highway users, they will not necessarily lessen the apparent overrepresentation of older people in highway accidents. This is best achieved by measures that will help older drivers and pedestrians overcome those specific problems that lead to highway accidents and injuries. That is a role that training attempts to play.

Training can make highways safer for older drivers and pedestrians in two ways. One is by ameliorating the problems that lead to accidents and injuries. One such problem is simple lack of information. The highway transportation system has changed a great deal since most older drivers first learned how to

drive. It is evident that many have not kept abreast of the changes, as shown by the number of older drivers who come to a complete stop at the end of a freeway acceleration lane. Similarly, many older pedestrians are unfamiliar with Walk cycles and do not know what to do when the signal changes to Don't Walk when they are halfway across the street. Training can attempt to ameliorate these problems by providing up-to-date information.

Unfortunately, not all of the problems that affect the safety of older drivers and pedestrians can be overcome through training. A second role of training is that of helping older people to recognize and compensate for the effects of their deficiencies. For example, drivers who recognize that they have trouble finding their way in unfamiliar areas can allow someone else to act as navigator and avoid blazing new trails during heavily traveled times of the day.

Learning Requirements of the Elderly

Research fails to disclose any substantial differences between the elderly and other adults in what is required for effective learning. Outside of the need to accommodate the visual and hearing impairments of some students, the general principles of adult learning are as applicable to the elderly as to younger adults. Adult learning principles applicable to the training of older drivers and pedestrians can be succinctly summarized as follows:

1. *Instructional method*: Adults are much more responsive to instruction that allows them to interact with one another than they are to lecture. Not only are they less familiar with the lecture format than their younger counterparts, but they generally have more relevant experience to share with one another.
2. *Outside study*: The availability of reading material to permit outside study helps not only to reduce the burden on classroom instruction but also to accommodate the wide variation in learning rates that characterize older populations. Highly interactive classroom instruction provides an incentive for outside preparation.
3. *Familiar referents*: Adult instruction is made more interesting and more understandable by use of familiar referents. For example, right-of-way rules can be discussed in the context of a well-known local intersection; the problems of rush-hour traffic can be discussed in relation to local arteries.
4. *Physical arrangements*: The visual, hearing, and other impairments of some older students can be accommodated by (a) keeping class size relatively small, (b) prescreening films and slides to make sure that important material is legible, (c) seating impaired students where they can see and be heard, (d) using large print for all texual materials, and (e) providing frequent breaks.

CURRENT STATE OF THE ART

A variety of training programs have been offered to older drivers and pedestrians to help them overcome and compensate for age-related problems. Any attempt to assess the state of the art in driver and pedestrian training requires some prior determination of what such training can be reasonably expected to do. Therefore, this discussion will start with a summary of age-related problems that need to be overcome or compensated for, which of these problems are being addressed by existing driver and pedestrian training programs, and new developments in the training area.

Problems To Be Addressed by Training

Those problems of older drivers and pedestrians that affect traffic safety and are appropriately attacked through training are addressed here on two different levels. The first includes mental and physical problems that have been known to be related to both age and safety, such as vision, memory, knowledge, strength, and frustration. These are both problems that are the direct result of the aging process and those that result from age-related health conditions, such as cardiovascular disease or arthritis. The second level includes performance problems that are believed to relate to age and safety. Many of these result primarily from the mental and physical conditions related to the first set of problems.

It is important to emphasize that the problems to be addressed in this section, although age-related, are not universal concomitants of age. Only a small portion of the older population is significantly deficient in driving-related activities. The result is greatly increased variation across drivers rather than a general decline among all drivers. This variation is particularly great across age levels within what is considered the older population, with some functions showing no appreciable deficit until 70 or 80. Also, certain of the differences between older and younger drivers may not reflect changes in individuals themselves so much as differences that have existed in the age groups from the start. Younger age groups as a whole have the benefit of better nutrition and freedom from a variety of diseases, to say nothing of more information and experience relating specifically to driving. Many of the problems described in this section may lessen as younger age cohorts reach advanced years.

Mental and Physical Problems

A number of physical and mental functions have shown a relationship with both age and safety on the highway. For purposes of discussion, these functions will be subdivided into the sensory, perceptual, cognitive, motor,

and affective. Much of the information provided is drawn from recent reviews by Staplin et al. *(21)* and by Yanik *(22)*. Although both of these reviews were concerned specifically with drivers, the problems discussed affect the safety of pedestrians as well.

Sensory Functions Vision is the sensory function most closely tied to age and safety. Although hearing is certainly age diminished and is believed to be important to the safety of both drivers and pedestrians, research shows little relationship between hearing loss and highway accidents.

Summaries of the relationship between vision and accidents have been provided by many studies *(23–25)* and the recent summary of age in relation to visual functions has been provided by Staplin et al. *(21)*. From these sources, it is possible to piece together a picture of the impact on driving of diminished visual capacities such as static visual acuity, dynamic visual acuity, low-illumination acuity, visual field, contrast sensitivity, binocular depth perception, dark adaptation, glare resistance, and glare recovery. These problems are more fully discussed in the two papers in this volume by Schieber and by Bailey and Sheedy.

Obviously, the sensory problems noted cannot be directly overcome through training. However, through training, older drivers and pedestrians can be helped to recognize the nature and possible consequences of visual problems, as well as to seek ways of correcting them and compensating for them. Of the problems listed, only static acuity is open to correction, although improving static acuity will improve other aspects of visual performance. Many of the remaining deficiencies can be compensated for in driving. For example, compensatory behaviors include (a) avoiding driving under low illumination, which helps to offset deficiencies in visual acuity (particularly at low illumination), dark adaptation, and glare recovery; (b) increasing the frequency and speed of the scanning pattern to offset reductions in visual field; (c) wearing dark glasses during daytime; (d) avoiding substances that might degrade night vision (alcohol, poor diet); and (e) avoiding traffic and highway conditions that present heavy visual demands, for example, having to read street signs in fast-moving traffic.

Although sensory problems are not quite so debilitating to pedestrians as to drivers, they are still a threat to safety. Through instruction, pedestrians can be helped to recognize and compensate for lessened ability to hear approaching vehicles, to spot them in their periphery, or to judge the speed at which they are closing.

Perceptual and Cognitive Functions A number of perceptual and cognitive problems have been shown to relate to both age and traffic safety. These include the following:

1. *Knowledge*: McKnight and Green *(26)* found older drivers to be somewhat deficient relative to their younger counterparts in their knowledge of

many aspects of driving law and practice. These differences may result not so much from loss of information as from the lack of formal instruction at the time they first learned to drive and their failure to keep abreast of changes that have occurred since.

2. *General attention*: Hoyer and Plude *(27)* and Quilter et al. *(28)* found that ability to maintain general attention declined with advanced age, whereas Kahneman et al. *(29)* found performance on a test of attention to be related to accidents.

3. *Selective attention*: Older people tend to experience increasing difficulty in separating important from unimportant information *(30–32)*. The decrement appears to be due in part to redundant processing of irrelevant information by older people *(33)*. Deficiencies in selective attention have been found to be predictive of traffic accidents *(34, 29)*.

4. *Attention sharing*: The ability to shift attention has been found to be age-related by Craik *(35)* and by Parkinson et al. *(36)*. The relation of attention sharing to accidents has been demonstrated by Mihal and Barrett *(34)* and by Kahneman et al. *(29)*.

5. *Information processing*: A decline in the speed and accuracy with which information is processed has been found among the elderly by Braune et al. *(37)*, Welford *(38)*, and Rackoff *(39)*.

6. *Problem solving*: Although the solution of complex problems is not often required in driving, deficiencies in problem solving might manifest themselves in reduced ability to handle confusing signs and directions and to find destinations. Studies by Case et al. *(40)* and Arenberg *(41)* show a decline in problem-solving ability during later years. The study by Case et al. involved driving tasks performed in a simulator.

7. *Memory*: Short-term memory is a factor in the ability to recall signs and directions. Age-related declines in short-term memory are reported by Arenberg *(42)*, Miller *(43)*, and Welford *(38)*. Craik *(35)* and Bacon et al. *(44)* found no such decline, but Rackoff *(39)* found it under conditions in which recall was interrupted by another task.

Of the various problems described, those dealing with knowledge are most readily overcome through training. Indeed, providing knowledge is one of the things that training does best. Research by McKnight and Edwards *(45)* shows that providing information to experienced drivers can improve their safety of operation provided there are means to ensure that the information is learned in the first place.

There is little evidence that any of the other perceptual-cognitive problems can be overcome through training. One study of field dependence showed improvement among elderly drivers in field-dependent tasks after a lengthy training program *(46)*. However, it is impossible to tell whether the drivers learned to overcome their field dependence or simply learned to perform the

tasks better. The study did not measure changes in field dependence as related to other tasks or to actual driving. Similar reservations apply to a study that claimed to obtain improvement in the peripheral vision of older drivers through training *(47)*. What improved was the recognition of silhouettes, and an equal improvement occurred without training. Arenberg *(41)* found improvement in a visual retention task through practice alone.

Whether or not training can truly overcome limitations in perceptual-cognitive functioning, it can certainly help older people identify and compensate for their problems. Compensating measures include (a) minimizing the amount of driving done under conditions that impose a heavy perceptual and cognitive load (extensive driving or unfamiliar surroundings), (b) enlisting the cooperation of others to help share the load (allowing a passenger to navigate or read road signs), and (c) exercising alternatives to reduce the perceptual-cognitive load (for drivers, using less-traveled roads; for pedestrians, crossing only at controlled intersections).

Motor Functions The following aspects of motor capability have been found to be related to age and accidents:

1. *Reaction time*: Probably the simplest motor capability is reaction time. Although this function has been widely tested among drivers, it has not shown significant relationships with accidents for age. Olson and Sivak *(48)* found no difference between younger and older drivers in time to respond to road hazards. Quimby and Watts *(49)* obtained a similar result for responses to filmed hazards. So-called "choice" reaction time, where certain cognitive functions intervene between stimulus and response, has been more vulnerable to the effects of age, but is really more appropriately considered a perceptual cognitive function.

2. *Motor skills*: Brainin et al. *(4)* found older drivers deficient in motor control skills including backing, lane-keeping, maintaining speed, coming to a stop, handling curves, and negotiating left turns. There is, however, no research linking these deficiencies specifically to accidents.

3. *Motor disabilities*: A number of pathological conditions can limit a driver's strength, range of motion, and coordination *(11)*. Some of these are age related, including arthritis, hemiplegia (stroke), and Parkinson's disease. A number of other motor disabilities that are more numerous within the older population simply because there has been more time for such disabilities to occur include loss of limbs or other disabilities resulting from disease or accident. Brainin et al. *(50)* reviewed a number of investigations into the relationship between various disabilities and traffic accidents with no conclusive result. However, McKnight *(51)* found that physically disabled drivers paid a penalty in inconvenience, discomfort, and fatigue.

Although no formal research into remediation of motor skill deficiencies could be found, a substantial improvement in vehicle control skill as a result

of in-vehicle training conducted by the American Automobile Association (AAA) has been reported. Most of the improvement was attributed to simply learning the correct skills, which suggests that some of the deficiencies observed by Brainin et al. were due to lack of proper instruction at the outset. Even where age-related physical disabilities are irreversible, AAA reports that their effects can be greatly offset through selection of appropriate vehicles and use of vehicle accessories and special aids designed to assist physically limited drivers.

Affective Variables The foregoing discussion of age-related problems has focused solely on variables related to the ability to drive. A number of variables relating to the emotions (affective variables) have also shown relationships with both age and driving. Research has found older drivers to be lacking in confidence and aggressiveness *(4)*, to display stubborn and selfish behavior *(52)*, to be inclined to underestimate risk in driving *(53)*, and to be more competitive and less willing to admit mistakes *(54)*. Among pedestrians, Mathey *(55)* reports a tendency to shade traffic rules in their own favor and a tendency to expect drivers to make allowances for them. The caveats offered earlier concerning differences among individuals and cohort effects should be borne in mind when interpreting the results of these studies.

The literature discloses no studies involving the attempt to modify affective variables among older drivers specifically. Only one systematic attempt to improve driving through affective change has been reported *(56)*, and the small sample employed rendered the results less than conclusive. However, it would seem desirable to inform older drivers of the nature of affective changes that tend to occur late in life and their possible effect on driving. Although there is no assurance that older drivers will recognize or do anything about such changes, an effort to overcome the effects of such changes is more likely to be made if drivers are aware of the changes that are occurring.

Performance Problems

Turning from the mental and physical problems that produce unsafe performance to the unsafe behavior itself, information concerning age-related performance problems comes primarily from studies of driver performance, records of traffic violations, and accident reports. Information concerning performance problems of older pedestrians comes primarily from accident reports.

Performance Studies A number of researchers have observed the driving behavior of older people *(4, 40, 57–60)*. Because the various studies overlap considerably, it is pointless to attribute specific findings to individual studies. The specific problems include the following:

1. *Speed*: misjudging speed, driving too slowly, excessive braking;

2. *Search*: inattention, inadequate scanning, failure to observe to the rear, and pulling out without looking;
3. *Vehicle control*: less precise visual control, including deficiencies in maintaining path, maintaining speed, changing lanes, coming to a smooth stop, backing, left turns, and right turns.

Nolan *(61)*, Ysander and Herner *(12)*, and McKnight et al. *(62)* provide information about performance problems reported by drivers themselves. Many older drivers reported that when they had been drinking or had taken medication, it was becoming increasingly difficult for them to handle traffic conditions, as well as backing up, entering and leaving expressways, changing lanes, passing, entering and leaving parking spaces, handling intersections, turning left, and driving when tired.

Use of alcohol appears to be less of a problem among older drivers and pedestrians than it is for younger age groups *(63, 64)*. When drinking problems are encountered, they tend to have arisen late in life as a result of frustration, depression, or a stressful event *(65)*.

In contrast to alcohol, drugs of the legal variety seem to be a somewhat greater problem among older drivers and pedestrians than their younger counterparts. Although the elderly make up 11 percent of the population, they purchase 25 percent of both prescription and over-the-counter drugs. One study found that those over 65 averaged 13 prescriptions a year *(66)*. In addition to the danger posed by the direct effects of these drugs is the increased danger resulting from different pharmacological reactions and interactions among drugs *(67)*.

Traffic Violations The types of traffic violations sustained by older drivers have been summarized by Waller *(68)*, Planek and Fowler *(69)*, Harrington and McBride *(70)*, and the National Safety Council (NSC) *(15)*.

The most frequent citations for older drivers involve failure to heed stop signs, traffic lights, no-left-turn signs, and other signs and signals. These citations have not been attributed to willful disregard so much as to the failure of older drivers to take notice. These behavior deficiencies have been attributed to more fundamental deficiencies in vision, general attention, selective attention, attention sharing, field independence, and information processing. Older drivers are also frequently cited for right-of-way violations, but these are primarily in connection with accidents.

Accidents A third source of information concerning age-related performance deficiencies is the accidents in which older drivers and pedestrians become involved. Information on the relative involvement of older drivers in accidents has been provided by Brainin et al. *(4)*, McKnight et al. *(62)*, Moore and Sedgely *(71)*, Partyka *(72)*, and Maleck and Hummer *(73)*. The overinvolvement of older drivers in accidents includes the following categories:

1. *Right-of-way*: Most right-of-way citations are issued for intersection accidents in which the cited driver was judged to be at fault. The typical reason for a right-of-way violation is the failure of one driver to see or adequately judge the speed and distance of an approaching vehicle. Such accidents are judged to be the consequence of driver problems with general attention, selective attention, judgment of speed and distance, and field dependency, as well as lack of adequate visual search.
2. *Left turns*: Many right-of-way violations involve left turns. To the problems underlying other right-of-way violations may be added limitations of visual field, which hamper detection of an oncoming vehicle as the older driver looks to the left along the intended path.
3. *Backing and parking*: Backing and parking accidents are generally attributed to physical difficulties that make it difficult for many older drivers to rotate their upper torso to see parked and approaching vehicles behind.
4. *Slowing and stopping*: In rear-end collisions, older drivers are more likely to operate the vehicle that was rear-ended. Many of these accidents result from sudden slowing or stopping in the traffic stream. Contributing factors are believed to be confusion, resulting from deficiencies in vision and information processing, and inordinate slowing for turns, necessitated by physical inability to turn the steering wheel quickly.

Studies of pedestrian accidents do not reveal marked differences between elderly pedestrians and other adults *(20, 55, 75–77)*. Problems leading to accidents among elderly pedestrians include the following:

1. *Gap judgment*: misjudging the distance of approaching vehicles and the interval between vehicles;
2. *Attention*: stepping off of the sidewalk while distracted, following other pedestrians into the street after the light has changed;
3. *Visual search*: walking into pedestrians who are approaching, watching the traffic light instead of traffic;
4. *Expectation*: misinterpreting the motion of motor vehicles, assuming that other drivers will yield;
5. *Haste*: impatiently crossing after waiting, crossing mid-block between parked cars.

There is a possible cohort effect in pedestrian behavior. As pointed out by the Organization for Economic Cooperation and Development (OECD) *(78)*, the elderly of the future may not perform like those of the present. Also, it should be noted that the fault for pedestrian accidents does not lie entirely with pedestrians. Howarth and Lightburn *(79)* found that drivers tend to look to pedestrians to resolve conflicts. Also, Zuercher *(80)* found drivers to be more aggressive toward pedestrians who look old.

Performance Training Needs All of the performance problems that have been described define training needs. Some of the problems simply result from lack of awareness of appropriate performance, for example, not knowing how to properly enter or leave a freeway. The training need here is rather simple—to provide instruction in proper procedure. Other problems arise out of diminished capabilities that cannot be easily altered. Training in such instances must help drivers compensate for deficiencies. For example, although drivers may not be able to correct the perceptual and cognitive deficiencies that often cause them to become confused and stop suddenly, they can be taught to respond to their confusion in ways that are less injurious, such as continuing with the traffic flow until the first opportunity to leave it safely.

A truly effective training program is one that not only teaches the proper way to do things but also anticipates the most likely errors and helps students to guard against them. One of the shortcomings of training programs for older drivers in past years has been that not many have instruction tailored specifically for older drivers. Although they may do a good job of describing the right way to do things, they do not help students to anticipate and overcome the specific mistakes that they are liable to make.

Driver Training and Information Programs

A great number and variety of training programs have been developed to help make driving safer and more comfortable for older people. The earliest training programs for older drivers were typically local ones conducted by universities, automobile clubs, and safety councils. Until the 1980s, the only national program available was the Defensive Driving Course offered by NSC.

Three national programs that have been specifically tailored to older drivers are 55 Alive/Mature Driving of the American Association of Retired Persons (AARP), Safe Driving for Mature Operators of the AAA, and the recently developed Coaching Mature Drivers of the NSC. The AARP program, having the organization's entire membership to draw from, has the largest annual enrollment—over 200,000 in 1986. By the close of the decade, an annual enrollment of approximately 300,000 to 400,000 is projected. No other program for older drivers approaches these numbers at the present time. The annual enrollment in the AAA program is somewhat under 10,000 per year. The NSC program was only recently completed.

Content of Training Programs

The most important aspect of any training program, including a program for drivers or pedestrians, is its content—what it teaches. Many of the early

programs for older drivers were driver improvement programs, with little or no attempt to tailor their content to the specific problems of age. For the purpose of discussion, content can be divided into two categories:

1. *Age-general*—instruction that addresses the problems of all drivers, and
2. *Age-specific*—instruction that deals specifically with the problems of older drivers.

Most of the training programs for older drivers are quite comprehensive with respect to general information. However, they vary considerably in the extent to which they deal with the problems that have been identified in the previous section. Although the various programs give extensive coverage to the specific problems of age, they do not go into all of the training needs that have been described. Perhaps the greatest shortcoming is not helping drivers to anticipate some of the specific problems they are likely to encounter, such as not being able to turn far enough to look over the shoulder on lane changes or to look out the rear window when backing, or tending to slow or stop suddenly when confused. This is not a criticism of the programs; it may not be possible to teach, within the 8-hr length of the three programs cited, all the content needed to fully address all the problems with which older drivers are confronted.

Training Methods

Almost all the programs intended for the improvement of older drivers, including the three just mentioned, are taught entirely in the classroom. A few of the organizations that conduct these and other programs also offer in-car instruction. However, students rarely take it. In-car instruction provides an effective way of identifying the specific deficiencies of individual drivers, both to the instructor and to the student. Brainin et al. *(4)* concluded on the basis of their road test of older drivers that in-car instruction could be of considerable benefit to older drivers.

The primary reason for the absence of in-car instruction in most programs for older drivers is economic. Even when drivers furnish their own vehicles, the cost of in-car instruction can range from $25 to $50 an hour as compared with as little as $10 for an entire 8-hr classroom program. The AAA program offers in-car instruction as an option but reports that only about 5 percent of the students elect to take it. About three-fourths of these are women.

Program Support

The three major older-driver training programs are supported both by the organizations developing the program (AARP, AAA, and NSC) and by the

older drivers participating in the program. Support from the developing organizations includes the cost of developing the curriculum and its materials as well as the cost of publicizing the program. The personnel and facilities costs associated with actually giving the program are supported by student fees. The participation of local businesses and private agencies has often been enlisted to provide publicity and facilities. For example, over 200 banking institutions now cooperate in administration of the 55 Alive/Mature Driving program through the cooperation of the AARP and the American Bankers Association.

Enrollment Incentives

By far the most vexing problem in efforts to improve the performance of older drivers through training is simply getting drivers to take it. A study by McKnight et al. *(81)* indicated that less than 2 percent of the licensed driving population would voluntarily enroll in a driver improvement program. In the past the overwhelming majority of drivers enrolled in programs like the Defensive Driving Course were either employees whose organizations covered the costs and permitted attendance on company time or those convicted of traffic violations, who were attending in order to reduce accumulated points or to keep from having their licenses suspended. Current incentives for participation beyond the prospect of self-improvement include insurance discounts and license retention.

Insurance Discounts The device that has been increasingly used to induce the older driving population at large to enroll in training programs is the insurance discount. Reductions in insurance premiums of 5 to 10 percent have been offered to drivers who complete approved programs.

In recent years groups seeking increased enrollment in driver improvement programs have succeeded in obtaining legislation that specifically provides for insurance discounts. In a few states, the legislation merely permits underwriters to offer discounts and in others discounts are required. In addition, some states fix the amount of the discount and others leave it up to the insurance companies. In 19 states, the discount is extended only to older drivers; in 3 states, it is offered to participants of any age.

The rationale for offering insurance discounts is that participation in a program will lower the participants' accident liability and therefore reduce their claims. The state of New York found that drivers taking the driver improvement programs had a better loss-premium ratio than those who did not, even after a 10 percent premium discount *(82)*.

The soundness of a discount from an actuarial viewpoint does not depend on the effectiveness of the program in reducing accidents. Research has shown rather consistently that drivers who volunteer to participate in any type of

safety-oriented program have better traffic records than those who do not, both before and after the program. Simply volunteering to participate in a program is an indication that a driver is a better risk than the population at large. A problem arises when an insurance company is already giving a discount to drivers with good records. If a training program does not actually reduce accidents, the discount that drivers are offered may not reasonably exceed that received already.

Currently, the enrollment in older driver training programs is relatively low. Even the 200,000 enrolling in the AARP program corresponds to less than 1 percent of the eligible membership, and only a portion of the enrollment actually comes from the membership. In New York only 1 to 2 percent of all eligible drivers were enrolled in driver improvement programs in 1983-1985, despite the offer of a 10 percent insurance discount *(82)*. Unfortunately, no breakdown of participation rates by age is available. Although insurance discounts are apparently effective in inducing many older drivers to participate in training programs, only 1 to 2 percent of the eligible population is represented.

License Retention As mentioned earlier, one source of enrollment for driver improvement training programs is those convicted of traffic violations. The earliest violator training programs operated through referral from individual courts. Judges would offer convicted offenders the opportunity to attend a driver improvement program in lieu of license suspension. The availability of training programs provided judges an alternative to purely punitive sentences. As states began to keep records of traffic violations and set up a formal process for dealing with repeat offenders, a driver improvement course often became a step in that process. Some courses were operated by the state; others operated under referral from the state.

The literature discloses no driver improvement system in which special courses have been set up specifically for older offenders. Such special courses would be very difficult to administer. Drivers over 55 account for an extremely small proportion of the violator population and to form classes of sufficient size to be practical would, in most areas, introduce an extensive delay between conviction and treatment. This problem would not, of course, arise if there were regularly scheduled courses for older drivers to which offenders could be referred. However, organizations that run such courses are typically loathe to put violators in the same class with those who are there voluntarily.

In some states drivers who have volunteered to take courses have been allowed to earn credit that could be applied to future traffic violations. It takes but a moment's reflection to realize the absurdity of allowing traffic violators to escape penalty because of prior participation in a program that obviously did not work. In most instances, the provisions that allow drivers to "bank"

credit for training against future violations resulted from quirks in the law that have since been eliminated.

The need and desire to retain a driver's license can be a powerful motivator in the case of older drivers. A way in which this motivation might be exploited to induce far greater participation in training programs will be dealt with later in the discussion under New Developments in Training.

Driver Information Programs

Most of the time spent in current driver improvement programs is devoted to the simple delivery of information. Obviously, there are other ways to receive information than sitting in a classroom, and a number of efforts have been made to provide information through other means.

A recent report by Worthington et al. *(83)* identifies a number of systems for delivery of traffic safety information to older drivers and pedestrians. Although the various systems are not evaluated in either absolute or comparative terms, the findings point to organizations with which older people have frequent contact as offering the best access route. These organizations include churches, senior centers, retirement groups, professional and trade associations, physicians, and various types of stores (particularly supermarkets).

Broadcast and print media are reported as having ready access and high credibility with older people. However, the prospects or means of getting messages disseminated to such a circumscribed target group as the older population have not been described. The authors note that public service announcements are singularly inappropriate because of the hours at which they are generally presented. Some 21 organizations are identified as being prepared to develop and distribute informational materials to older drivers and pedestrians *(83)*.

Although informational programs can reach a far greater segment of the older driving public than the 1 to 2 percent reached by formal training programs, they have no way to ensure that the information provided is being read and absorbed. When information is delivered in a classroom, instructors can take steps to make sure that students are paying attention, including giving tests, calling on students in class, and conducting discussions. However, when information is delivered through handouts or mailouts without any requirement to read the material, the effect on driving performance is often nonexistent *(84)*. About the only step that can be taken to see that it is read and absorbed is to make it intrinsically interesting. This can be a formidable task when the information being disseminated concerns the audience's own deficiencies or the risk to which these deficiencies expose them.

One avenue of communication with older drivers that has been utilized in the past is the license renewal process. Here written material can be coupled

with a license examination to provide an incentive to study and absorb the information. Research has shown such coupling of materials and tests to be effective in reducing accidents *(45, 85)*. Special manuals for older drivers have been prepared by the U.S. Department of Transportation and AAA. Use of the licensing process as a means of communicating information to drivers is discussed more fully in the paper by Waller in this volume.

Unfortunately, the trend in recent years has been away from renewal testing. To reduce the length of lines in licensing stations, many states have permitted renewal by mail for drivers with clean records. This issue will be dealt with further, along with other possible ways of reaching older drivers, in the next section.

Basic Driver Training

The discussion up to this point has been confined to training and information programs intended for the improvement of older, experienced drivers. There are, however, significant numbers of drivers each year who are seeking instruction to learn how to drive. Some have never driven before, whereas others learned to drive when they were much younger but have done little driving in recent years.

No statistics are available on the age distribution of older drivers in basic driving school instruction. However, an informal survey of driving schools shows that the single biggest group in the older-driver population consists of married women who, because of the death or illness of a husband or merely the desire for independent mobility, are learning to drive or starting to drive again. The size of this group has been diminishing, and should continue to do so as the older age groups are characterized by women who learned to drive early and who have continued to drive on a regular basis.

Remedial Instruction

Many experienced drivers are afflicted with disabilities that alter the nature of driving tasks for them and necessitate substantial relearning. Some of these disabilities are age related, such as arthritis and hemiplegia. Other disabilities such as loss of limbs, although not age related, tend to be more common among older people simply because with passage of time the likelihood increases that an older person will be exposed to conditions producing a disability.

A number of remedial instruction programs have been established for recently disabled drivers, primarily by rehabilitation hospitals and clinics and by universities *(86, 87)*. These programs offer special training aids such as simulators and modified vehicles. Most severely disabled drivers become

aware of these resources through the medical facilities at which they are treated.

Paradoxically, the biggest problem in providing remedial instruction is with drivers having less severe disabilities. They are often treated in hospitals that do not specialize in rehabilitation and where personnel are not knowledgeable in the resources that are available. This leaves it to the afflicted drivers not only to retrain themselves but to discover which diminished capabilities need retraining.

Effectiveness of Programs

There has been as yet no truly conclusive evaluation of the effectiveness of training or information in improving the performance of older drivers. As far as programs dealing specifically with older drivers are concerned, not many evaluations of effectiveness have actually been attempted.

Training Programs The most ambitious attempt to evaluate an older-driver training program was that reported by McKnight et al. *(62)* in which volunteers from the AARP program were randomly divided into two groups. The "trained" group was offered the program immediately, whereas those in the control group were deferred to a date after the evaluation had been completed. The two groups were then compared with respect to self-reported accidents (which were verified to have included officially reported accidents).

No differences materialized between drivers participating and those not participating in the program. Unfortunately, only 21 percent of the 10,000 drivers who volunteered to participate in the training program actually finished and furnished follow-up accident data. Curiously, the proportion of drivers in the control group who furnished follow-up accident data was identical—21 percent. However, the drivers remaining in the two groups were no longer random samples. Although the trained and control groups had the same accident rate before the program, they differed significantly with respect to a wide range of variables. Those who volunteered for and completed training had significantly fewer prior traffic violations and drove fewer miles. Despite this bias, the reported accident rate following administration of the program was almost identical for the trained and control groups. The results do not prove the ineffectiveness of the AARP program in particular or older-driver training in general. The lack of adequate numbers and statistical control prevented a conclusive evaluation.

The inability to maintain the randomness of groups being compared in evaluation of the AARP program is a problem that has been encountered in evaluating most adult driver-training programs. Although drivers can be assigned to programs at random, no one can force them to participate in the program to which they have been assigned. Given the volunteer nature of

older-driver training, the prospects of ever conducting a truly conclusive evaluation are not good.

The only alternative to a pure, random experimental evaluation of older-driver training is a quasi-experimental comparison, in which groups that volunteer for training are compared with those who are not, with differences between the groups being controlled statistically. Some recent evaluations of adult training programs for motorcycle operators have shown that differences between volunteer and nonvolunteer groups are largely eliminated when control is maintained for age, sex, prior experience, and driving record *(82, 88)*.

Information Programs The only highly controlled experimental evaluation of older-driver information programs found in the literature is that reported by McKnight and Edwards *(45)* in which 8,000 license renewal applicants over age 55 were randomly divided into two groups, one group taking a test based on its content, the other group renewing licenses without having taken a test. A subsequent analysis of driving records showed no significant differences in accidents or violations over a 2-year period. These results conflict with those that were obtained from drivers in other age groups. The authors speculate that a more favorable outcome might have been obtained had the sample size and the range of information provided been as great as that for the other age groups.

Pedestrian Training Programs

There are two aspects to providing pedestrian training programs: developing an effective program and building an effective delivery system. The latter may well be the more difficult; pedestrians are harder to reach than drivers, who must apply for a license.

European Programs

Europe has been far ahead of the United States in developing pedestrian interest groups. The International Federation of Pedestrians is made up almost entirely of pedestrian groups from European countries. These groups serve as pedestrian advocates, working with federal and local governments and the media, and also provide educational programs. Although most of these are for children, where the major interest lies, some have been tailored to the elderly, containing materials distributed by pamphlet or the media or sometimes verbally by traffic officers and others in the traffic safety establishment.

In England local road safety offices have the responsibility for providing instruction to elderly pedestrians within their jurisdictions. This responsibility is met primarily by visiting organizations for the elderly to show films, give

talks, and distribute printed materials. They also work through personnel of social service agencies, visiting health services, and volunteer groups *(89)*. The content of instruction includes the importance of (a) wearing glasses and hearing aids when they are required (i.e., not taking them off when going outside); (b) not going out under conditions of poor visibility, slippery surfaces, or high-density traffic; (c) being as conspicuous as possible; (d) using what safety facilities are available (e.g., footbridges and subways); (e) crossing at proper locations; and (f) using the "green cross" code for crossing streets *(90)*.

Mathey *(55)* emphasizes that training must be in real traffic and must teach the elderly to "deal flexibly" with actual and difficult traffic situations. The AAA *(74)* also emphasizes that the most effective way to train is on the street. Swedish *(91)* and Dutch *(92)* work with children has also shown this to be essential. However, not only is such a program expensive, there is no reasonably extensive delivery system and persuading people to invest the amount of time required for such programs would be difficult.

A review of pedestrian training throughout Europe by OECD *(78)* concluded that group approaches, such as presentations in retirement clubs or homes, were not very effective because many people are required to train very few. They recommended individualized approaches in which older pedestrians are provided information through families, home health services, and home helpers.

U.S. Program

In the United States, there are three organizations with ready access to large numbers of the elderly and concerned for the safety of elderly pedestrians: AAA, AARP, and NSC. Each has a program under way.

The AAA's aim was to produce guidelines for local communities *(74)*. They point out that programs depicting the elderly as decrepit are offensive and that this picture is not true of the elderly outside institutions (about 95 percent of elderly). The AAA training program involves three $^1/_2$-day sessions, the last one involving practice in real traffic in the street. It is the only one that provides advice on techniques to practice. The real question is whether people will invest the time required and whether it can reach a large number of the people who really need it.

The AARP's program *(93)* has different aims. The emphasis is on the individual's responsibility for his own safety (which includes the advice to cease trusting drivers to do the right thing), awareness of safety measures of all types in the community, and political activism for better safety measures, along with advice on how to organize and run a concerned citizens' group.

This approach is expected to get people more involved than a purely informational program and also has the potential for reaching more people than just the groups trained. In addition, the sponsoring organization is large and composed entirely of the target group. The program is brief: a one-hour presentation of slides with a taped commentary, followed by group discussion.

The NSC has a contract to implement the Federal Highway Administration's Operation Pedsaver. The aims are (a) to produce a program implementation guide with handout literature and a complete set of material for the promotion and coordination of a pedestrian safety program, (b) to develop grassroots support for pedestrian safety, and (c) to solicit program sponsors *(94)*.

New Developments in Training

The 1980s have not been years of significant programmatic inquiry into the improvement of older drivers or pedestrians. However, some developments that have occurred outside the realm of programmatic study involve reexamination, self-appraisal, and subscription television.

Reexamination

Licensing agencies reexamine drivers both at periodic intervals and whenever there is cause to question their ability to drive safely. Use of reexamination purely for purposes of renewing or not renewing licenses lies outside the scope of this paper and is well covered by Waller elsewhere in this volume. However, the reexamination process can also be used to induce drivers to enroll in and complete training programs. Given the difficulty in finding suitable training incentives, the possible use of reexaminations is worth considering.

The state of Illinois now offers a 3-hour classroom program on rules of the road to help drivers prepare for the written examination. It is offered at some 520 locations around the state in order to be readily accessible to everyone. Although not exclusively for older drivers, its attendance comes primarily from that group.

Although programs such as that in Illinois are encouraging, they obviously do not reach all eligible drivers. Some 16 states do not even require in-person license renewal if a driver has a clean traffic violation record. Only three states selectively test older drivers.

An alternative to the use of reexamination to induce participation in training is the authority that license administrators have to test any drivers for cause. The "cause" is typically a record of persistent traffic violations. Actually, few violators are tested because few violations are the result of inability to drive.

In this case, "reexamination" more often means an interview, hearing, or instruction program.

Currently, reexamination of older drivers occurs primarily in response to complaints from members of the driver's family. However, several states have instituted procedures under which police officers who issue a traffic citation to an older driver can indicate on the citation whether they believe that the violation results from some deficiency on the part of the driver. When a copy of the citation reaches the licensing agency, it triggers a request that the driver come in for a reexamination. Although the reexamination may result in a written or road test, or both, it could also take the form of an instruction program. No state currently appears to employ reexamination for this purpose.

In two recent efforts, tests have been developed that would quickly screen renewal applicants for sensory and perceptual-motor shortcomings capable of affecting driving. These tests use video display terminals that permit the testing to be integrated with automated color vision, choice reaction time, spatial judgment, and anticipatory tracking. By using an adaptive testing sequence, applicants manifesting no problems can complete the sequence in a few minutes. Only those showing difficulty would receive the full test, which could run 10 to 15 min. Applicants showing poor overall performance would then be required to take a road test. As yet, no such system has been tested on actual license applicants.

Self-Evaluation

One characteristic of older drivers that tends to be an obstacle to their participation in training and information programs is their reluctance to admit that their driving has become deficient. To help overcome this, training programs for older drivers often include self-evaluation checklists. The most systematically developed self-evaluation is that of Malfetti and Winter *(95, 96)*. Their self-appraisal presents 15 situations rated by older drivers for their frequency of occurrence: "always or almost always," "sometimes," "never or almost never." After answering the questions, drivers add up their scores, which place them in one of three categories: "stop" (red), "caution" (yellow), and "go" (green). The main body of the appraisal is, however, a detailed discussion of the issues addressed by the questions.

The 15 situations rated include affect (e.g., "traffic situations make me angry"), behavior ("I wear a seatbelt"), and interactions with the traffic system ("How many accidents have you had during the past two years?"). All are situations having special importance to the safety of older drivers.

Development of the self-appraisal form began with a large pool of situations and responses recommended by researchers and practitioners as being particularly critical to the operating safety of older drivers. Those showing

low correlations with the entire pool were eliminated. The reason for this is unclear. Certainly one would expect some correlation across responses, that is, for those who respond unsafely to one situation to respond unsafely to others. If increasing age leads to less safe responses, then some correlation should be induced merely by the differences in the ages of those responding. However, to delete a particular response because it does not correlate highly with other responses is questionable.

The self-reported scale showed positive but low correlations with the results of a road test (those practices that were on both the road test and the rating form only correlated .09 with one another). It is possible that a longer form, incorporating more situations, would provide a better overall appraisal of drivers. However, the purpose of the self-appraisal is not simply to measure potential, but to pave the way for improvement. A greater number of situations would have increased the length of the discussion portion of the self-appraisal, risking disinterest on the part of readers.

The self-appraisal developed by Malfetti and Winter is certainly a step toward the remediation of older drivers. It would be unfortunate if it were the last such step. Further investigation, encompassing a wider range of internal consistency, would seem to be necessary if the idea of self-appraisal is to be fully exploited.

Subscription Television

A new wrinkle in the search for ways of getting information to drivers is subscription—closed-circuit and cable—television. Small local cable television stations are often short of material to cover their programming hours. They therefore are characteristically a good outlet for public service information. Information bearing on the topics that have been described earlier has been aired in such forms as discussions; lectures by experts in the field; films, videos, or other audiovisual presentations; and televised public events bearing on problems of the older driver.

Probably the biggest limitation to the use of cable television is simply the rather small audiences that nonnetwork television tends to generate. However, viewing by the target audience could be enhanced by publicizing those programs dealing with the older driver in materials mailed to older people (pension checks, mailings from local old-age assistance groups) or through newsletters and other publications sent to older drivers.

A service that has increased markedly in recent years has been the creation of small, private, closed-circuit television stations operating under the auspices of certain groups by and for their own membership. Retirement homes have been among the leading sponsors of closed-circuit stations, which is due at least in part to the amount of spare time that people can devote both to running the station and to viewing the programs.

PROPOSED CHANGES

Discussions of the state of the art and new developments in training and information programs suggest changes that could be made to the benefit of older drivers and pedestrians. Those changes that seem to be most feasible to implement and most likely to produce beneficial results are improved instruction, increased enrollment, and better information dissemination.

Improved Instruction

The instructional programs that are available to help older drivers are comprehensive in scope and employ proven methodology. However, they are not without room for improvement. Areas in which content could be expanded include the following:

1. *Safety practices*: defensive driving, emergency procedures, and other aspects of safety practice that are potentially beneficial to all drivers, regardless of age;
2. *Common problems*: problems that most commonly affect drivers and pedestrians of advanced years as an aid in helping to detect the effects of such problems;
3. *Common errors*: the type of errors that drivers and pedestrians are most likely to make as a direct or indirect result of age-related problems; and
4. *Assistance*: ways in which the effects of problems can be eased through assistance by passengers, vehicle accessories, driving aids, and so on.

The organizations that have developed and offered programs for older drivers and pedestrians would do well to review the content of their programs systematically against a comprehensive list of learning needs. It may not prove feasible to accommodate all these needs in one or even a series of programs. However, the decision on content of the training program should be made in consideration of the full range of training needs and an attempt to rank these needs in terms of the extent of importance, their relation to safety, and the prospects for obtaining improvement.

Increased Enrollment

Obviously, the best instruction in the world will not accomplish very much if people do not take it. At this time it appears that less than 2 percent of older drivers, and even fewer pedestrians, are willing to enroll in formal programs of instruction. Significant steps toward increasing enrollment must be taken if training is to have a real impact on the safety of older drivers and pedestrians. Three such steps are use of insurance discounts, exploitation of the license process, and publicity.

Insurance Discounts

As incentives to participation in training programs, insurance discounts for older drivers are of limited value, as shown by the small proportion of eligible drivers seeking such discounts. Although publicizing the availability of both the programs and the discounts may increase the number of takers, the low enrollment among populations in which they are already publicized suggests that something more is required.

One obvious step in making discounts a greater incentive would be to increase the size of the discount to a point where it actually becomes an incentive to training and not merely taken for other reasons. It seems very unlikely that insurance companies will increase the size of the discount offered or that state legislatures will require a larger discount in the absence of convincing evidence that the training is producing a proportional reduction in claims. Such a demonstration may hold the key to an increase in both the size of insurance discounts and the number of states requiring that discounts be offered.

License Process

One shortcoming inherent in any volunteer driver improvement program is that those who voluntarily seek improvement are typically the ones who are least in need of it. For those who, through a poor traffic record or other evidence of unsafe performance, show a need for improvement, training can be made a condition for license retention. At this time, the majority of licensed drivers who are receiving driving instruction in the United States are doing so in order to keep their licenses. Steps that could be taken to make better use of the license process as a means of inducing participation in driving training programs by older drivers are the following:

1. *Screening*: Research should continue that would lead to quick screening methods capable of being integrated into the license renewal process to identify potentially unsafe drivers for more extensive examinations. An effective screening process must be (a) brief enough to avoid adding to the queues at licensing stations, (b) automated to minimize requirements for additional personnel, and (c) reliable enough to identify drivers with severe problems and not involve large numbers of false positives.
2. *Reporting*: Techniques should be devised that will aid and encourage police, family, friends, and others to accurately identify those with conditions leading to unsafe driving and to refer them to licensing agencies for examination.
3. *Referral*: Those drivers, as revealed through screening and reporting processes, who are capable of alleviating or compensating for their problems through instruction should be identified and referred for training.

Experience with the Illinois license renewal training program suggests that introduction of a screening program will produce a substantial increase in the numbers of older drivers volunteering for instruction. Proportions might be further increased by coupling the examination process with training. Pennsylvania, for example, by allowing instructors to administer a license examination more than trebled the number of enrollees in a motorcycle safety program.

The use of license reexamination as a means of inducing participation in training is hampered by (a) resistance to requiring reexamination on the basis of age alone, (b) the lack of a screening process capable of quickly identifying potentially hazardous conditions during the routine renewal testing of all drivers (coupled with a reduction in renewal testing generally), and (c) the lack of a widespread program for early identification of problem drivers through analysis of accidents and traffic violations. These issues obviously affect training, but they are really licensing issues and, as such, lie outside the scope of this paper. However, the potential role of licensing in encouraging training should be considered. Any changes in the licensing process as it applies to older drivers should not be limited to the question of who may or may not be licensed but should include the conditions under which a license may be retained, with participation in training being one of those conditions.

Publicity

Drivers and pedestrians cannot participate in instructional programs if they do not know about them. The literature review disclosed no surveys involving public awareness of the training programs that are available, but it is the belief of those operating the programs that lack of awareness is one of the chief obstacles to widespread participation. A much more ambitious effort to publicize the existence of programs, their content, and benefits of participation (particularly discounts) should certainly be initiated. Efforts to publicize programs can make use of the same access routes to older drivers that would be used to disseminate more general driver and pedestrian safety information.

Better Information Dissemination

Even with all the inducements to participation that have been described, it is optimistic to think that even a substantial minority of older drivers or pedestrians will participate in formal instruction programs. The rest must be reached through less formal channels of communication. Public information approaches that can and should be greatly utilized include the following:

1. *Private sector*: Greater involvement in disseminating public information should be sought by private-sector organizations having frequent contact

with the elderly. The participation of the American Bankers Association in administration of the 55 Alive/Mature Driver program provides a good example of the way in which the private-sector organizations can provide access to older drivers and pedestrians. Any organization having significant numbers of older people among its clientele is a candidate for a similar type of involvement.

2. *Public assistance agencies*: Individuals and organizations providing assistance to the elderly provide a potential avenue of communication that is now underutilized. These resources include physicians, hospitals, clinics, and other organizations providing service to older people and to their relatives and friends. Supplying such contacts with timely and accurate information concerning problems of older drivers could aid them in providing more and better assistance. Physicians can distribute information that will help older drivers anticipate the debilitating effect on their driving of whatever illness they are being treated for.

3. *Affinity groups*: Older people have shown an increasing tendency to band together in retirement communities, mutual-help organizations, and social and recreational groups; this grouping can be exploited to distribute available driver and pedestrian informational materials. Such materials could include pamphlets and brochures, posters, videos, and lists of speakers. The costs of such materials could be underwritten by public and private organizations.

RESEARCH NEEDS

This discussion has highlighted three areas in which further research is clearly needed: (a) behavioral causes of accidents, (b) identification of deficient drivers, and (c) effectiveness of training programs.

Behavioral Causes of Accidents

The ability of training to reduce older-driver and pedestrian accidents could be greatly improved by focusing particular attention on those behaviors most likely to lead to such accidents. The pedestrian behaviors leading to highway accidents have been rather well identified. However, the behavior of drivers is less readily observable and therefore less often reported. Although research cited clearly sheds some light on the behavioral antecedents of drivers, it falls far short of pinpointing behavioral causes.

What would be of greatest benefit to the identification of behavioral causes would be in-depth investigations of accidents involving older drivers. A number of multilevel accident investigations have been conducted in past years, but none has focused specifically on accidents involving older drivers.

The samples include all ages; nevertheless, the numbers of older drivers have been quite limited—particularly the numbers of truly elderly drivers.

The National Accident Sampling System (NASS) is an ongoing accident investigation program capable of furnishing in-depth behavioral information. The system uses police reports across the country to select proportional samples of accidents. Frequently, various categories are oversampled for in-depth information on variables of particular interest (e.g., heavy vehicles). It would take a highly disproportionate sampling of accidents involving elderly drivers to furnish enough behavioral information to make reliable estimates of the extent to which various behavioral problems contribute to older-driver accidents. Such a sample would be capable of providing valuable input to the improvement of older-driver training programs.

Identification of Deficient Drivers

If drivers cannot be called in for reexamination on the basis of age alone, the only way of identifying deficient drivers to refer for training would be through some rapid screening process that could be applied to drivers of all ages. As previously noted, such a process must be expeditious enough to avoid creating queues in license stations, fully automated so as to avoid imposing additional personnel requirements, and accurate enough to assure identification of deficient drivers without large numbers of false positives. Outside of some very recent unpublished work, little effort has been undertaken along these lines. The MARK II vision tester described in Schieber's paper in this volume deals solely with deficiencies in vision and requires far too much time to be employed in routine license screening. Although there is no assurance that any system meeting the specified requirements can be developed, the potential value is sufficiently great to warrant further exploratory research.

Effectiveness of Training

The prospects of public support through training of older drivers could be enhanced by valid evidence of its benefit in improving safety and mobility. The availability and magnitude of insurance discounts are particularly sensitive to training effectiveness.

The most conclusive form of research, random experimentation, is unlikely to prove feasible when the treatment (training) is purely voluntary. However, quasi-experimental comparisons of those who elect and those who do not elect to take training are capable of providing an acceptable assessment of training effectiveness with (a) collection of adequate data on accident-related variables and (b) use of appropriate statistical controls to isolate the effects of training. The comparisons that have been performed to date have not met these conditions.

CONCLUSIONS AND RECOMMENDATIONS

Based on the research and practice that have been studied in the preparation of this paper, the following conclusions and recommendations can be offered.

Conclusions

1. To reduce the vulnerability of older drivers and pedestrians to traffic accidents and at the same time preserve their independent mobility, there is a need for programs of information and education.
2. The effect of diminished capabilities leading to the unsafe performance of some older drivers and pedestrians can be significantly reduced by modifying or compensating for such performance.
3. A number of driver and pedestrian training programs have been developed to address age-related problems. These programs are available to almost everyone at little cost.
4. Current driver and pedestrian information and education programs reach but a small fraction of the people who could benefit from them. Even where insurance discounts are available to the drivers who complete training, participation does not exceed 2 percent of the population.

Recommendations

1. The effectiveness of older-driver training should be assessed by comparing the accident records of trained versus untrained drivers, with statistical control over demographic characteristics, prior driving record, mileage, and other factors that might affect the relative accident exposure of the groups being compared.
2. Should training be found an effective accident countermeasure, efforts should be undertaken to induce greater numbers of older drivers to participate in training programs. Such efforts should include (a) publicizing the availability of insurance discounts and increasing their size, where appropriate, and (b) identifying drivers whose records of accidents and violations indicate a need for remediation and requiring their successful participation in training as a condition for license retention.
3. States should develop processes to facilitate and encourage reporting to the licensing authority those drivers whose observed performance indicates that they are potentially hazardous to themselves and others. The processes should be adapted to the specific needs of law enforcement officers, physicians, family, and friends.
4. The participation of private business, public assistance agencies, and volunteer groups should be enlisted in the efforts to disseminate to older drivers and pedestrians (a) information capable of improving their safety and

mobility and (b) information concerning the availability of training and informational programs.

5. A survey to identify the means currently used by states to identify unsafe drivers and a program of research should be undertaken to devise rapid, automated, and reliable screening methods capable of cost-effectively identifying potentially deficient drivers for more intensive examination.

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