

Signs of Deficiency Among Elderly Drivers

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Most referrals of older drivers to motor vehicle departments for reexamination are made by police. A sample of 1,000 completed referral forms used by police was obtained from five states and analyzed to identify the bases of referral. Accidents were found to serve as the leading source of contact between police and older drivers, closely followed by traffic violations. The bases of referral for reexamination (in order of decreasing frequency) were sensory deficiencies, mental states, attentional deficiencies, medical conditions, motor deficiencies, cognitive deficiencies, other aberrant behavior, physical deficiencies, a history of driving problems, and the testimony of others. The relative involvement of these referral bases were constant over the age range represented by older drivers except for sensory deficiencies (vision and hearing), which increased in frequency with age, and medical conditions, which declined in frequency. Although significant differences were observed among states, the differences are outweighed by the similarities, and the results from the five states provide a reasonably reliable estimate of the bases for reexamination referral across the country. The preponderance of problems that would not be readily apparent to medical practitioners points to the need for routine, periodic reexamination as a means of ensuring the safety of both older drivers and the motoring public.

The overinvolvement on a per-mile basis of elderly drivers in automobile crashes is well established. The elderly have a higher accident rate than any other age group except beginning teenagers. Their absolute number of accidents is kept in check by the lower number of miles that the elderly travel.

The most vexing aspect of the elderly driver population is its heterogeneity: for every deficient driver there are many more who are safer than they ever were. The challenge in regulating the access of elderly drivers to the public highways is distinguishing the safe from the unsafe. The ordinary periodic renewal licensing process is not well equipped to handle this, and even if society allowed motor vehicle departments to call in all of the elderly for a more intensive examination, it might be too expensive.

One way to identify potentially unsafe elderly drivers is through traffic law enforcement. When an elderly driver is stopped for a violation or involved in an accident, police have an opportunity to observe signs of incompetence that often lead to referral to the state licensing agency for reexamination. Indeed, it appears that in most jurisdictions, police are the primary source of referrals. For example, police are responsible for three-fourths of Michigan's 5,000 annual referrals.

Law enforcement is the primary source of reexamination referral, but it is a source that is far from fully used—witness the large number of law enforcement agencies and officers that make very few referrals, if any at all. Either they are extremely fortunate in rarely encountering deficient drivers or they are simply not prepared to take action when they do.

One reason that law enforcement agencies and personnel may not make more referrals is that they are unable to identify deficient drivers when they see them. Either they do not know the signs of deficiency or they are not secure enough in their knowledge to be willing to act. Unfortunately, the scientific community is not in a position to be of much help. Most of what we know about elderly drivers comes from research using laboratory testing techniques that are not available to the police on the highway.

OBJECTIVE

The objective of the exploratory study described here was to identify the signs of driver deficiency that enforcement personnel have used as a basis of referral for reexamination. The signs include (a) unsafe behaviors observed by officers, including those that form a basis for traffic citations; (b) unsafe behaviors underlying accidents investigated by officers; and (c) signs of deficiency observed in drivers by officers in the course of issuing citations or investigating accidents that do not themselves point to deficiencies. This study addresses the following questions:

- What are the specific signs that alert law enforcement officers to the possibility that elderly drivers are deficient with respect to the functions required for safe driving?
- Which signs, or combinations of signs, appear often enough to warrant their becoming elements of a referral process?
- What differences exist across age levels within the elderly driver population?

METHODS

The means by which signs of driver deficiency were identified is through documented records created by law enforcement officers as part of the referral process. A number of jurisdictions provide forms on which police can record the observations that led to the referral of individual drivers. The forms may be distributed by the state licensing agency, the law enforcement agencies, or both.

It is the enforcement officer's description of observations that provides probable cause to request drivers to report for reexamination. The amount of detail in which the cause is described varies enormously, from a few words to several paragraphs. The degree of detail appears to depend more on the insight and the meticulousness of the officers than it does on the characteristics of the drivers themselves. For this reason, any review for research purposes could be confined to

those states providing the more detailed descriptions, without introducing significant bias into the outcome.

Selection of Sample

Five states participated in the study: California, Maryland, Massachusetts, Michigan, and Oregon. These states met the following three criteria: that they be able to readily identify older drivers, that they be able to single out drivers referred by police, and that the referral forms contain a narrative from which it would be possible to extract the information forming the basis for the police referral.

Each state was asked to provide approximately 200 randomly selected copies of older driver referrals with identifying information deleted. Referrals that were not sufficiently detailed to determine the signs of deficiency that triggered them, or that pertained to drivers younger than 60, were eliminated. After the selection process was complete, the data consisted of 1,000 usable referral forms. The breakdown by state is given in Table 1.

Data Entry

The following data were entered from each police referral form into a computer data base for analysis:

- State of subject residence,
- Age and gender of subject,
- Narrative description of accident or circumstances that caused police officer to come into contact with the subject, and
- Narrative description of each cue that the officer noted pertaining to the subject.

Data Analysis

Since there was no predetermined classification of referrals, the first 100 entries were studied in order to arrive at appropriate categories. These categories involved the basis of initial contact, the behaviors leading to the contact, and the deficiencies that served as a basis of referral.

Basis of Contact

The incident that brought the subject to the officer's attention was coded for analysis in the following categories:

- Accident,
- Violation,
- Observation, and
- Outside sources.

Contributing Behaviors

At the time that an officer interacted with an aging driver, the specific behavior contributing to that contact was identified. These behaviors included

- Driving the wrong way or on the wrong side of the street;
- Driving off the road;
- Rear-ending a vehicle;
- Failing to yield right of way or come to a complete stop at a stop sign;
- Infringing on the rights of a pedestrian or cyclist;
- Turning across the path of oncoming vehicles;
- Crossing lane markings;
- Backing improperly;
- Operating at low speed; and
- Other behaviors.

Basis of Referral

After initial contact with an older driver, enforcement officers reported a number of deficiencies that served as a basis for referral. The referral signs were broken down into the following general categories:

- Aberrant behavior,
- Attentional deficit,
- Cognitive deficit,
- History of problems,
- Licensing irregularities,
- Medical problems,
- Mental problems,
- Motor-related deficits,
- Physical problems,
- Sensory-related deficits, and
- Testimony of others.

RESULTS

The true "results" of the data collection effort were a set of older driver characteristics taken from the narratives of police referral forms. Only a review of these individual entries will reveal the actual basis for driver referral, but some insight into the patterns of driver characteristics exhibited can be gained by examining the categories of referral cues, along with the frequencies associated with each.

Basis of Initial Contact

The following table provides a breakdown of contacts with elderly drivers according to the nature of the incident that called the driver to the officer's attention:

TABLE 1 Breakdown of Subjects by State

State	Gender		Total
	Male	Female	
California	125	72	197
Maryland	146	68	214
Massachusetts	141	91	232
Michigan	88	57	145
Oregon	123	89	212

Source of Contact	N	Percent
Accident	486	48.1
Violation	443	43.9
Observed behavior	70	6.9
Outside referral	11	1.1

The leading source of contacts is accidents in which the older drivers were involved, followed closely by violations committed by the older driver. The simple observation of aberrant behavior was responsible for relatively few contacts, and a small percentage involved someone else calling the officer's attention to the individual driver. Most referrals from relatives, friends, physicians, or others are made directly to the motor vehicle department rather than to the police. Relatively few referrals by police officers were based on the characteristic of accidents or violations themselves. Instead, they resulted from an officer's evaluation of a driver's appearance or behavior during the interaction that followed.

Contributing Behaviors

A summary of the specific behaviors involved in accidents, violations, and observed driving is given in Table 2. The primary behaviors that brought drivers to the attention of officers were driving the wrong way down a one-way street or on the wrong side of a two-way street, which contributed to many violations but few accidents; operating off the paved surface, which contributed to many accidents, but few straight violations; and failing to yield or stop for other traffic, which contributed to significant numbers of accidents and violations. Making unsafe turns across the paths of oncoming vehicles, a mistake in which older drivers are generally recognized as being overrepresented, was half as frequent as the behaviors just described and was found equally often in accidents and in violations that do not involve accidents. Other contributing behaviors were driving very slow, rear-ending another vehicle, backing improperly, failing to observe lane markings, and not yielding to pedestrians and bicyclists.

Basis for Referral

The older driver characteristics that served as a basis for re-examination referral are presented in Table 3. Since more

TABLE 2 Frequency of Behaviors Contributing to Accidents, Violations, and Observations of Officers

Behavior	Accident	Violation	Observation	Total
Wrong way	29	149	13	191
No yield/stop	74	114	3	191
Off road	176	8	1	185
Turning across traffic	46	43	0	89
Slow speed	0	56	9	65
Rear-ender	49	0	1	50
Backing	32	1	1	34
Crossing lane marking	5	25	0	30
No yield to pedestrian or cyclist	16	5	3	24
Miscellaneous/missed	58	43	39	140

TABLE 3 Basis for Referring Elderly Drivers for Reexamination by Police

Characteristic	N	Percentage
Sensory deficiency	358	15.9
Mental state	354	15.8
Attentional deficiency	312	13.9
Medical condition	236	10.5
Motor deficiency	228	10.1
Cognitive deficiency	225	10.0
Aberrant behavior	199	8.9
Physical condition	174	7.7
Personal history	110	4.9
Testimony of others	51	2.3
Total	2,247	100

than one observed characteristic may have led to the referral, the total frequency across all characteristics adds up to more than 1,000 incidents.

Sensory Deficiencies

A total of 358 incidents involved apparent sensory deficiency, the overwhelming majority of deficiencies being visual. Deficiencies included impaired vision (149), impaired hearing (93), poor depth perception (47), degraded night vision (41), and vision problems related to medical conditions such as cataracts or recent surgery (28).

Mental States

Most of the deficiencies discussed involve driver abilities. Several other mental and physical characteristics involve what might be better described as "states" or "conditions." Mental states associated with referral for reexamination include being confused (170), disoriented (98), lost (46), "senile" (15), drowsy or fatigued (12), and other problems of a mental sort (13).

Attentional Deficiencies

The category attentional deficiencies involves incidents in which the officer noted behavior indicative of attentional deficiencies. In many cases, drivers themselves acknowledged attentional lapses. Specific conditions included admission of being generally unaware or inattentive (171), failure to notice another vehicle (73), failure to notice a traffic control (30), and not being aware of what they had done that resulted in a violation or accident (38).

Medical Conditions

A variety of diagnosed medical conditions were identified as the bases of driver difficulties leading to referral for reexamination. They include complaints of "blacking out" (67), diabetes (26), heart condition (22), stroke (18), Alzheimer's disease (13), fainting or dizziness (13), arthritis (9), Parkinson's disease (8), seizure (4), epilepsy (3), and other medical problems (28).

Motor Deficiencies

This category included deficiencies in motor behavior that were not related to apparent medical conditions or physical shortcomings. The most frequently mentioned deficiency was what appeared to be slow reaction time or slowed reflexes (110), followed by inappropriate manipulation of controls, such as stepping on the gas instead of the brake (84), and generally poor motor coordination (34).

Cognitive Deficiencies

Four categories of information-related deficiency involve lack of recall (123), inability to comprehend (51), failure to know the rules of the road (26) and inability to process information in making sound decisions (15).

Aberrant Behavior

The category aberrant behavior does not include all instances of aberrant behavior, just those in which the investigating officer could not identify any other underlying problem or deficiency. The 199 instances divided themselves as follows: taking too long to pull over despite the officer's use of lights and sirens (120), having difficulty in producing identification when requested (40), failing to stop and identify themselves after an accident (36), and driving off after stopping for the officer and having to be chased down (30). Such behavior probably involves some of the deficiencies making up the rest of Table 3, but it was not obvious to the officer, or from the officer's description, which of the deficiencies were involved.

Physical Conditions

Those physical conditions resulting in referral include observed difficulty in walking (63), shaking or tremors (55), physical disability or handicap (35), general weakness (16), and extremely short stature (5).

Other Characteristics

The remaining two bases of referral involve the testimony of a relative, physician, neighbor, or other that would give rise to concern over the driver's ability to operate safely (38) and some specific prior history of driving problems that has come to the attention of the officer (6).

Twenty-seven elderly drivers were referred to licensing agencies because of licensing irregularities rather than any identified shortcomings to the drivers themselves. These irregularities included not wearing glasses, and claiming not to need them, despite license restriction requiring that glasses be worn (14) and issues related to vehicle registration, driver's license, or insurance (13).

Police also recorded 122 instances of unusual affect on the part of the elderly driver, although in no case did it serve as a basis for referral. Sixty instances of strange, bizarre, erratic,

or other unusual behavior were also noted even though they were not basis for reexamination.

The referral bases are not broken down separately by accidents and violations because, for the most part, the deficiencies noted in connection with accidents followed the same pattern as those found in violations without accidents. The two exceptions were the following:

- Aberrant behavior, which made up 14 percent of the signs associated with violations alone (as opposed to 4 percent of the signs noted in connection with accidents) and 6 percent of instances in which officers stopped a driver for observed behavior without even an accident or violation.

- Medical conditions, which accounted for 14 percent of the signs associated with accidents but only 5 percent of signs associated with violations and 7 percent of signs associated with observed behavior.

In no other case did the percentage of accidents involving a particular deficiency differ more than 3 points from the percentage of violations involving that deficiency.

Driver Deficiencies by Age

Although all of the drivers referred for examination were elderly and referred because of age-related problems, differences among drivers in the age categories represented are, for the most part, small and easily attributed to chance. However, four categories of deficiencies show substantial age-related trends. They are given in Table 4.

All of the comparisons in the table are statistically significant. Because they have been selected from a large number of comparisons, they must be treated as hypotheses instead of conclusions. Nevertheless, the very large differences involved provide some assurance that they represent true age relationships.

Two of the comparisons involve bases of referral, and the others involve behaviors leading to the driver being stopped. The most startling finding is the marked decline in the incidence of medical problems as age increases. Since the percentages reported are all relative to other types of deficiencies, the decline cannot be attributed to reduced total driving. These findings do not necessarily mean that medical problems decline with age, but they could mean that drivers affected with these conditions are less willing or able to drive as they become older. The increasing relative incidence of sensory problems with age reflects what might be an expected decline in sight and hearing with increasing years.

TABLE 4 Selected Deficiencies by Age Group

Characteristic	Age				χ^2	p
	< 75 (%)	75-80 (%)	80-85 (%)	> 85 (%)		
Sensory	9.3	14.9	19.0	15.9	26.1	< .001
Medical	19.8	8.0	5.2	2.8	130.4	< .001
Wrong way	23.3	19.9	18.4	12.3	9.6	.05
Off road	26.5	17.4	13.2	14.2	20.5	< .001

NOTE: Deficiencies expressed as percentage of all deficiencies within age group.

There is no ready explanation for the decline in incidence of driving the wrong way or off the road with increasing age. They may reflect changing exposure to various road and traffic conditions instead of changes in drivers themselves. No significant differences were found between the relative involvement of accidents, violations, or observations as the basis of enforcement contact ($\chi^2 = 13.88, p = .13$).

Consistency of Results

The ability to generalize results from the five participating states to the nation as a whole can be estimated from the consistency of collected data. If the five states show similar patterns of results, it is likely that the sample provides a reasonably accurate estimate of population patterns.

A simple and direct measure of the agreement among samples would be the correlation among states and the frequency with which various characteristics were observed. The intraclass correlation among states, representing the average correlation between all possible pairs in the five states, was .66 both for the behaviors contributing to the initial contact and for the basis of referral. This correlation represents moderately high agreement in each case. The estimated correlation between pooled results for the five states and those of another set of five states selected in the same manner is .91. Even though there are substantial differences among states, they are outweighed by their similarities, and the totals presented in Tables 2 and 3 provide reasonably good estimates of what will be found in the nation at large.

Since the basis of initial contact only involves three categories, relationships are not well expressed in terms of correlation but can be readily grasped by mere inspection. Table 5 presents the breakdown of accidents, violations, and observations by state, expressed in percentage to facilitate comparison.

Marked differences can be seen from one state to another. For example, three-quarters of the contacts with elderly drivers from Michigan arose from accidents, whereas accidents accounted for one-third of the contacts in Oregon. These differences are probably due to variation in enforcement policies and practices rather than state-to-state variation in characteristics of elderly drivers.

DISCUSSION OF RESULTS

The true results of the study that has been described lie in the inventory of specific signs used by police in referring elderly drivers to motor vehicle departments for reexamination, but the summary statistics generated from these results are illuminating. Although substantial differences appeared among

the states relative to the behaviors contributing to an accident or the violation giving rise to a referral as well as among the deficiencies that served as the basis of referral, the similarities outweighed the differences. What differed substantially among the states was the degree to which referrals arose from accidents versus violations, a difference that is probably due more to enforcement practices than to characteristics of drivers.

One finding of interest is the role that functional deficiencies involving attentional, sensory, cognitive, and motor deficiencies play in the incidents leading to referral. Currently, much of the effort in dealing with elderly drivers is focused on diagnosed medical problems, with hospitals and rehabilitation clinics attempting to serve the needs of the afflicted as well as the driving public. A sharp decline in the relative involvement of medical conditions beyond age 75—dropping from 19.8 to 2.8 percent—suggests that the efforts of the health practitioners to control the various medical conditions, or driving under their influence, are generally successful. By contrast, the relative involvement of sensory deficiencies in police referrals increases from 9.3 to 15.9 percent. Such deficiencies tend to be the result of gradual deterioration and are therefore not likely to come to anyone's attention except through some sort of periodic screening process.

From the data available, it is not possible to assess the accuracy of police in identifying driver deficiencies. Descriptions of events preceding a referral provide insight into the nature of driving deficiencies, but follow-up investigation is needed to identify the specific nature of conditions giving rise to the deficiencies described. Yet, given descriptions of behavior that accompany referrals, it is clear that the law enforcement community is providing a valuable service, both in bringing driver deficiencies to the attention of the licensing authority and in providing information that can help guide further examination.

That almost half of the referrals arose in the course of investigating an accident is cause for concern, even though there is no evidence of the degree to which identified deficiencies of aging driver actually contributed to the accidents. It appears advantageous to the health of elderly drivers and the safety of the motoring public to detect deficiencies of elderly drivers through some other means than their involvement in accidents. These results underscore the potential advantage of screening measures that would permit deficient drivers to be identified through the licensing process before they come to the attention of law enforcement officers. Most of the deficiencies that have been described lend themselves to diagnoses through available testing techniques. The task will be to find ways of adapting testing techniques to the limited time available for driving screening.

CONCLUSIONS

On the basis of the data collected as a part of this study, the following conclusions can be reached:

1. Behaviors leading to identification of deficient drivers include, in order of generally decreasing frequency, driving the wrong way, failing to yield or stop, leaving the roadway, turning across oncoming traffic, driving excessively slowly,

TABLE 5 Basis of Contact by State

Basis of Contact	Percentage					Total
	CA	MA	MD	MI	OR	
Accident	45	57	40	75	34	49
Violation	50	31	54	16	59	44
Observation	5	11	6	5	6	7
Total	100	100	100	100	100	100

having rear-end collisions, backing, crossing lane markings, and failing to yield to pedestrians or bicycles.

2. Driver characteristics contributing to these behaviors included, in order of generally decreasing frequency, sensory deficiencies, mental states, attentional deficiencies, medical conditions, motor deficiencies, cognitive deficiencies, testimony of other parties, observed aberrant behavior itself, physical conditions, and information concerning a driver's personal history.

3. The relative frequency of various behaviors and driver characteristics showed little variation over the elderly age range except for a gradual increase in sensory problems and a marked decline in medical problems.

4. Although the enforcement community appears to be successful in identifying substantial numbers of deficient drivers, the fact that almost half of the referrals resulted from accidents points to the need for greater use of routine screening as a part of the licensing process.

5. Research is needed to devise methods of identifying deficient drivers that (a) are effective in distinguishing deficient from qualified drivers, (b) can be practically implemented as a part of the license renewal process, and (c) will lead to

licensing actions that are appropriate to the specific deficiencies identified.

ACKNOWLEDGMENTS

The authors are indebted to the following individuals for obtaining and forwarding samples of license reexamination referral forms from their states: Gilbert Von Studnitz, California Department of Motor Vehicles; Jackie Anapolle, Massachusetts Registry of Motor Vehicles; Lucile Haislip, Maryland Department of Motor Vehicles; Mary Stamboni and Noian Holmes, Maryland Motor Vehicle Administration; Homer Smith, Michigan Department of State; and Peter Nunenkamp, Oregon Department of Transportation. The authors also wish to express their appreciation to A. Scott Tippetts, who performed the statistical analyses, and Marcia Zior, who prepared the manuscript.

Publication of this paper sponsored by Task Force on Safety and Mobility of Older Drivers.