Automobile driving and Alzheimer's disease

K. Shemon, MEd, RNC
R. Christensen, RN, MS

Abstract

Automobile driving surveys designed for drivers, nondrivers, and caregivers were mailed to 70 patients with a diagnosis of probable Alzheimer's disease and to their caregivers. The MMSE score of patients who were driving (n=16) was significantly higher (23.9 vs. 11.7 $p < .001$) than that of nondrivers. Other factors such as age, accident rate, and caregiver driving status did not differ. Caregiver surveys were utilized not only to validate patient responses, but also to identify their concerns. Actual behind the wheel test reports of 12 Alzheimer patients demonstrated serious deficiencies in judgement and in performance.

K. Shemon, MEd, RNC, Geriatric Research, Education and Clinical Center (GRECC), Minneapolis, Minnesota.

The nature of the problem

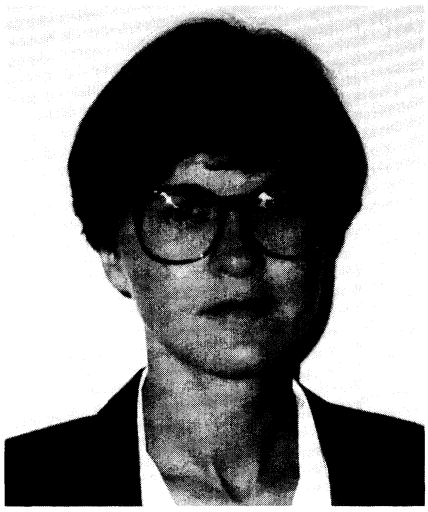
"He was gone for over two hours, alone in the car. He had promised he would only go two blocks for a newspaper. It was a terrifying experience."

"It's not easy to have to depend on my wife all the time ... and to think that I'll never drive again."

"He had always done the driving and it was very difficult for him to have to give up that privilege."

"One feels isolated and somewhat helpless; so dependent on others."

"I still feel a great loss of control [over giving up driving]."



R. Christensen, RN, MS, Geriatric Research, Education and Clinical Center (GRECC), Minneapolis, Minnesota.

Alzheimer's disease (AD) is a common neurological condition that affects 10 percent of people over the age of 65.[1] It is estimated that by the year 2030, there will be 4 million cases in the United States alone.[2] The disease is characterized not only by a loss of memory, but also by changes in personality, judgement, and reasoning abilities.

All too often, the driving issue is not confronted by the family or a healthcare team member until the patient is involved in an accident or gets lost when driving alone.

Each stage of the disease presents new challenges and requires decision making for the patient and his or her family. One of the most difficult decisions surrounds the issue of when the patient should discontinue driving. Deciding becomes more difficult if the patient lives alone or the family has limited transportation options. All too often the driving issue is not confronted by the family or a healthcare team member until the patient is involved in an accident or gets lost when driving alone.

This paper begins with a brief review of the effects of normal aging on automobile driving. The results of a survey focusing on driving practices and concerns of AD patients and their caregivers will be described, along with a summary report of actual road test results. Recommendations for interdisciplinary team approaches in the area of automobile driving and the AD patient will be presented.

Degenerative changes in the cervical spine may limit head rotation, and therefore, affect vision to the side.

Effect of normal aging on driving ability

Numerous articles discuss the effect of normal aging on driving ability. Changes in visual function and the resultant potential disability have drawn the most attention; and rightly so, since 90 percent of information available to the driver is visual.[3] The aging process affects visual acuity,[4] the threshold for adaptations to low light conditions,[5] and peripheral visual field.[6] Persons with visual field losses in both eyes had accident and traffic violation conviction rates that were double the rate experienced by age and sex-matched controls.[7] These visual deficits of aging could explain why the elderly are frequently involved in accidents caused by incorrect yielding of the right of way or improper judging of the distance of an oncoming car or a car being followed.

It is estimated that 70 percent of persons over the age of 50 experience some degree of hearing loss.[4] This loss reaches a significant level for 30 to 50 percent of persons after age 65.[8] Degenerative changes in the cervical spine may limit head rotation and therefore affect vision to the side. Joint flexibility and muscle strength are diminished with age. A decline of 15 to 46 percent in muscle strength was found when comparing old age to young adulthood.[9] Independently, or in combination, these changes may impact driving ability.

Drivers with chronic medical conditions over the age of 60 experienced almost twice as many accidents per 1,000,000 miles driven than did younger drivers.[10] Additionally, there has been an association found between the use of prescription medications, such as minor tranquilizers, and motor vehicle accidents.[11]

Traffic violations such as speeding, reckless driving, or DWI's are rare in this population.

According to a National Safety Council Report in 1982, the over age 55 group are disproportionately involved in traffic accidents and fatalities. The only group that experiences a higher rate of traffic accidents are drivers between the age 16 to 25. Older drivers tend to drive shorter distances, drive slower, drive less at night, and avoid rush hour traffic in an effort to compensate for reduced psychomotor and visual skills. It was also found that accidents involving two or more cars were 3.5 times more likely to be fatal for older drivers.[12] According to the authors of the "55 Alive" course sponsored by the American Association of Retired Persons,[13] typical violations for older drivers include the failure to yield the right-of-way, improper turning and lane changing, and improper entering and exiting of freeways. Traffic violations such as speeding, reckless driving, or DWI's are rare in this population. One finding of a study sponsored by the Traffic Safety Bureau in New Mexico was that older drivers in their group who had problems with driving tasks and/or vision were often unaware of those problems.[14] A significant and potentially frightening note is that these study participants had all volunteered for the study.

Driving and dementia

An extensive literature review identified only two articles which specifically addressed the issue of automobile driving by patients who suffer from dementia. Thirty patients with a diagnosis of Alzheimer's disease were compared to 20 healthy age-matched control subjects.[15] Forty-seven percent of the AD subjects had had an automobile accident in the previous five years as compared to 10 percent of the controls. Sixty-three percent of the AD subjects had stopped driving. However, only 42 percent did so before an accident occurred. In addition, they found that the stage of the disease was not significantly correlated with the occurrence of accidents. The recommendation was made that patients with the diagnosis of Alzheimer's disease should not drive a motor vehicle.

Forty-four percent regularly "got lost" while driving.

Lucas-Blaustein, Filipp, Dungan, and Tune[16] reported the results of a questionnaire completed by 53 caregivers or informed relatives of patients referred to their dementia outpatient clinic. Patients who continued to drive had a mean mini-mental state

examination (MMSE) score of 20.2 (S.D. +/– 4.6). They noted that the accident rate of their patient group was 30 percent since the beginning of the memory loss symptoms. An additional 11 percent, while not directly involved in accidents themselves, were reported by the caregivers to have caused accidents. Thirty percent of their sample continued to drive and 80 percent of those drove alone at times. Forty-four percent regularly "got lost" while driving. Noting the lack of guidelines for clinicians in this area, these authors also recommended that patients who have an Alzheimer diagnosis discontinue driving.

Study questions included:

- What percentage of patients who have an Alzheimer diagnosis continue to drive?
- Do Alzheimer patients who continue to drive differ from nondriving AD patients in any of the following ways: age, MMSE, caregiver driving status, car accident/driving violation record within the past five years (prior to quitting), and recommendations to discontinue or limit driving?
- What influences patients with Alzheimer's disease to discontinue driving?
- Who most frequently advises the patient to discontinue driving?
- What percentage of Alzheimer patients who drive have caregivers who are concerned about the patient driving? How many think that the patient should give up driving?

To expand on the limited work that has been reported, we wanted to gain additional information regarding the dementia patient's driving habits, personal perception of driving ability, and caregiver concerns. We were also interested in who, if anyone, was addressing this issue with the patient and the family.

Most drivers [with AD] drove frequently, without restriction, and had not considered discontinuing driving at the time of the survey.

Methodology

The clinical records of all patients followed in a dementia clinic at the Minneapolis VA Medical Center were reviewed to locate patients with a diagnosis of probable Alzheimer's disease. Seventy patients were identified. These patients, along with their primary caregivers, were invited by letter to participate in an automobile driving survey. This initial mailing included a set of survey instruments with a request to return these unanswered if they decided not to participate. Patients were directed to the appropriate survey by responding to three initial questions identifying their current driving status. All questions were to be answered with "not applicable" as one of the choices where appropriate. This reduced the possibility of confusion due to skipping patterns among the questions. Caregivers were asked to assist in completing the patient survey as needed. A preaddressed stamped envelope was included. Reminder postcards were mailed three weeks later to patients who had not responded. Three separate surveys were designed for study use targeted to: AD patients currently driving, AD patients no longer driving, and to the primary caregiver.

Survey questions addressed the following:

- *AD patients currently driving* — driving frequency, personally-imposed limitations on driving, recommendations by others to discontinue/limit driving, formal driving test evaluations, and car accident/driving violation record.
- *AD patients no longer driving* — reason(s) they stopped driving, car accident/driving violation record before discontinuing driving, current transportation options, and difficulty in giving up driving.
- *Primary caregivers* — personal driving habits, limitations, car accident/violation record, concerns about the AD patient still driving (if applicable), impact of AD patient no longer driving (if applicable), and current transportation options.

Results

All surveys were returned. Five patients and seven caregivers chose not to participate in the study. One caregiver and one patient completed the wrong surveys so these data are not utilized in the analysis. Of the 64 patients who completed the study, 16 (25 percent) were still driving at the time of the survey.

Data obtained on the nondrivers are summarized in Table 1. Memory problems were identified as the primary reason given for discontinuing driving. Most had been encouraged to discontinue driving (generally the spouse); and all had found some other source of transportation.

Table 1. Nondrivers.

(N = 48)

Reason driving discontinued?	
Memory problem alone	31 (64%)
Medical problem alone	12 (25%)
Memory & Medical problem	4 (8%)
Other	1 (2%)
Difficulty in discontinuing driving?	
Yes	28 (58%)
No	19 (40%)
No response	1 (2%)
Encouraged to discontinue driving?	
Yes	34 (17%)
No	13 (27%)
No response	1 (2%)
If encouraged, who recommended?	
Spouse	23 (68%)
Doctor	10 (29%)
Driver's license office	1 (3%)
Who provides transportation now?	
Spouse/family/friends (informal)	28 (58%)
City bus/taxi/VA/handicak (formal)	0
Combination formal/informal	19 (40%)
No response	1 (2%)

Outlined in Table 2 are the responses of the Alzheimer patients who continued to drive (n = 16). Most drivers drove frequently, without restriction, and had not considered discontinuing driving at the time of the survey.

Table 3 compares drivers and nondrivers. The mean MMSE score was significantly higher ($p < .001$) for Alzheimer patients who continued to drive (23.9 versus 11.7), [t-test]. Patient age, caregiver driving status, recommendations to limit or discontinue driving,

Table 2. Drivers.

(N = 16)

Driving frequency?	
4 or more days/week	13 (81%)
No response	3 (19%)
Driving limitations?	
No restrictionss	10 (62%)
One restriction	3 (19%)
More than one restriction	3 (19%)
Formal driving evaluation since memory problems?	
Yes	1 (6%)
No	15 (94%)
Considered giving up driving?	
Yes	2 (12%)
No	14 (88%)

and the accident or driving violation record did not differ significantly between groups.

We controlled for the MMSE score by considering the survey results of only those patients (drivers and nondrivers) who had a MMSE score of greater than 17. No significant differences were noted in the other factors evaluated in this group (see Table 4).

Eighty percent of the caregivers of nondrivers drove, as compared to 75 percent of the caregivers of drivers. While half of the caregivers whose AD patient was still driving were concerned about this, only 13 percent actually thought that the individual should give up driving. These results are summarized in Table 5.

A significant and potentially frightening note is that these study participants had all volunteered for the study.

Driving road test results

At the Minneapolis VA Medical Center, patients may be referred to the kinesiotherapy department for an evaluation of automobile driving ability. A Bausch and Lomb visual acuity examination, along with a state automobile driving written examination are administered by the therapist. These are followed by an actual behind the wheel driving evaluation. When this process is completed, written recommendations regarding the patient's ability to operate a motor vehicle safely are returned to the referring physician. Results are then discussed with the patient and family. If indicated, repeat testing by the state motor vehicle department is recommended.

Table 3. Comparison of drivers vs. nondrivers.

	Drivers	Nondrivers
Total N	16 (25%)	48 (75%)
Age		
Mean	69.4	71.6
Range	56-83	59-85
MMSE Score		
Mean	23.9	11.7*
Range	14-29	0-28
Caregiver drives	13 (81%)	36 (75%)
Suggestions to limit/quit		
Yes	8 (50%)	34 (71%)
No	8 (50%)	13 (27%)
Accident	4 (25%)	8 (17%)
Driving violation	2 (13%)	2 (4%)

*Difference in means for drivers and nondrivers is statistically significant, t-test, $p < .001$.

Behind the wheel road examination reports of 12 probable Alzheimer's disease patients currently driving at the time of the testing were reviewed. MMSE scores of these AD patients ranged from 12 to 26 (mean 20) with a range of 56 to 76 years (mean 67.9). Commonly observed driving errors included:

- Incomplete stops at stop signs;
- Not utilizing signals or checking blind spots;

- Not keeping the car in the proper lane;
- Improper lane changes;
- Driving too fast for existing conditions; and
- Wide right turns.

One AD patient stopped at each "stop ahead" sign and one pulled off the road to yield the right of way to a city bus.

One AD patient stopped at each "stop ahead" sign and one pulled off the road to yield the right of way to a city bus. Difficulties in understanding road signs and improper use of the gas and brake pedals were frequently noted in the reports. None of the patients successfully completed the road test evaluation. Unfortunately, only five of these 12 patients were followed in the dementia clinic at the time of our survey. In a subsequent study it would be helpful to compare survey results and driving evaluations completed during the same time frame.

Table 4. Comparison of drivers vs nondrivers.

	Minimental > 17	
	Drivers	Nondrivers
Total N	15 (56%)	12 (44%)
Age		
Mean	69.5	70.6
Range	56-83	60-85
MMSE		
Mean	24.6	22.5
Range	19-29	18-28
Caregiver drives	12 (80%)	10 (83%)
Suggestions to limit/quit		
Yes	7 (47%)	9 (75%)
No	8 (53%)	3 (25%)
Accident	4 (27%)	4 (33%)
Driving violation	2 (13%)	0

Table 5. Caregivers. (N = 61)

	Pt. Drivers (N = 16)	Pt. Nondrivers (N = 45)
Driving frequency?		
4 or more days/week	8 (50%)	32 (71%)
Less than 4 days/week	4 (25%)	4 (9%)
Nondriver	3 (19%)	8 (17%)
No response	1 (6%)	1 (2%)
Concerns regarding patient driving?		
Yes	8 (50%)	N/A
No	7 (44%)	N/A
No response	1 (6%)	N/A
Should patient give up driving?		
Yes	2 (13%)	N/A
No	12 (75%)	N/A
No response	2 (13%)	N/A

Discussion

A convenience sample of 70 patients and caregivers followed in a large midwestern dementia clinic participated in an automobile driving survey. The percentage of Alzheimer patients who continued to drive (25 percent) in this study was less than the 30 percent noted by Lucas-Blaustein, et al.,[16] and the 37 percent reported by Friedland, et al.,[15] in 1988. The only statistically significant difference found between AD drivers and AD nondrivers in the current study was in the mean MMSE score (23.9 vs. 11.7). When attention was restricted to mild patients (those with MMSE scores >a 17) no significant differences were found in the other areas examined.

Although caregiver driving status was not reported in the studies by Friedland, et al., or Lucas-Blaustein, Filipp, Dungan, and Tune,[15,16] the current study found the great majority of caregivers did drive on a regular basis — and this was not dependent upon the driving status of the AD patient.

While not reaching levels of significance, there appeared to be a trend toward discontinuing or limiting driving if recommendations to do so were given. Statistical significance may be reached with a larger sample.

It was no surprise that the primary responsibility of encouraging the Alzheimer patient to discontinue driving fell on the caregiver. Although half of the caregivers of the AD patients who currently drove expressed concerns, only 13 percent felt the patient should discontinue driving. Several caregivers noted, however, that they were glad that this issue was being addressed and wished that the decision to limit or discontinue driving had not been theirs to make alone.

Many families are unwilling or unable to take the right to drive away from the Alzheimer patient ...

Recommendations

Based on the findings of this study and actual road driving reports, we feel that it is the responsibility of the clinical management team to consider and discuss safety risks (including driving) with the memory impaired patient and his or her family at the time of the initial evaluation and at all subsequent visits.

The family should not be left alone with this responsibility. Many families are unwilling or unable to take the right to drive away from the Alzheimer patient ("He has lost so much already." "He is o.k. as long as I ride with him and tell him when to stop and what to watch for.") Alternative transportation options need to be discussed with the patient and family. It is recommended that a complete driving evaluation be included as part of the initial workup for every patient who has a dementing condition and is still driving. Any limitations placed on the patient should be written down for later review by the patient and other family members who may not have been involved in the initial workup.

Our study was specific to a midwestern urban Veterans Administration Medical Center population. In addition to repeating this study with a larger and more diverse sample, the following questions should be addressed:

- Are there differences in the driving status of male versus female AD patients or/and rural versus urban populations?
- Is there a correlation between the number of miles driven and driving performance?
- Is driving performance better in familiar areas?
- Is driving performance improved when a "helpful" companion accompanies the Alzheimer patient? What specific information can or does this companion provide? Does this allow the patient to drive more safely and for a longer period of time as the disease progresses?
- What relationship exists among function status, neuropsychological findings, and driving ability?
- If given the choice, what percentage of families would relegate the decision regarding driving status of the patient to healthcare professionals or state licensure bodies?
- If the driver's license is revoked, do AD patients automatically discontinue driving?
- How can healthcare professionals better support the patient and caregiver regarding driving decisions?

It is recommended that a complete driving evaluation be included as part of the initial workup for every patient who has a dementing condition and is still driving.

California state law now mandates physicians to report all patients who have dementia to the Division of Motor Vehicle Services via the Department of Health (Title 17, 1987).[17] Those patients who are still driving are required to take a written test and a behind the wheel examination. If the patient passes the examinations, he or she will be reexamined on a periodic basis. All states should consider such legislation.

Until more data are available, we suggest erring on the side of overcautiousness regarding the issue of driving and Alzheimer's disease. We recommend that all Alzheimer disease patients who are currently driving be given a complete driving evaluation.❑

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