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CLINICAL REVIEW

Driving and dementia

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BMJ 2007;334:1365-9
doi:10.1136/bmj.39233.585208.55

Dementia is important in relation to driving. As the disease progresses the ability to drive safely is eventually lost and at that point current regulations demand that driving stops. Many patients continue to drive after dementia has been diagnosed,[1-5 w10] however, and withdrawal of their licence should not be undertaken lightly. A study highlighted the negative consequences of stopping people with dementia from driving.[w11] Stopping driving can limit access to family, friends, and services and is an independent risk factor for entry to a nursing home.[w12]

Traffic medicine has evolved significantly since the 1990s, with more emphasis on preserving mobility. As populations age and increasing numbers of older people drive[w1] general practitioners are key players in ensuring that older people are not constrained by an unfair attribution of risk.

Health professionals, however, practise in a society where the perception of older drivers is negative.[w2] This may stem from misconceptions about the impact of age related disease on driving: these misunderstandings also apply to medical journals, which commonly reproduce statements on the apparent increase in crashes per mile driven for older people,[w3] despite several studies having established that this is related to low mileage rather than to age.[w4 w5] Indeed major problems arising out of increasing numbers of older drivers[w6] have been shown to be unlikely, with improvements in driving occurring with successive cohorts of older drivers.[w7] Surveys of drivers aged more than 80 consistently show prudent driving behaviours.[w8] Even the presence of medical conditions is associated with a relatively modest increase in adverse driving events.[w9]

Sources and selection criteria

We carried out a literature search from 1966 to April 2007 of several electronic databases (Medline, PubMed, CINAHL, Embase, and the Cochrane Library) using the search strategy: [dement$.ti. OR alzheim$.ti.] AND [driv$.ti. OR auto$.ti. OR mobil$.ti. OR crash$.ti.] LIMIT to human AND English.
The references generated were checked for relevance on the basis of their title and abstract, and we followed up other references from the papers identified. We used the Google search engine to explore the internet. We also contacted the major stakeholder agencies for relevant information.

Crash data

The risk of crashes in patients with dementia has been extensively studied (table). Over the course of the disease evidence suggests that the risk of a crash is significantly increased. As a general rule, however, the risk seems to remain acceptably low for up to three years after the onset of dementia, by which time most patients have stopped driving. A more detailed analysis of data on crash risk in dementia is provided on bmj.com.

Who decides on medical fitness to drive?

Although the Driver and Vehicle Licensing Agency in the United Kingdom has the legal responsibility of deciding on medical fitness to drive, general practitioners and specialists have important parts to play (figure). The Royal College of Psychiatrists[13] and the General Medical Council[14] have gone to considerable efforts to clarify their expectations of reasonable practice. The council is clear that for several conditions (including dementia), doctors should not only advise patients of the possibility of stopping driving but also take steps to ensure that the relevant statutory authorities are informed of breaches of regulation if there is reasonable concern about public safety. Studies have found that psychiatrists have a poor knowledge of the guidelines issued by the Driver and Vehicle Licensing Agency and that relatively few patients are advised that they should not drive, although the reasons for this pattern of advice may be complex.[w17 w18]

What should I do in the clinic?

Whenever dementia is diagnosed it is vital to inquire about the driving status of the patient and to maximise traffic related health (for example, checking visual acuity, ensuring arthritis does not affect ability, and reviewing medications). The Driver and Vehicle Licensing Agency states that anyone holding a driving licence must, by law, inform the agency when given a diagnosis of any medical condition that might affect safe driving (box 1).[15] Providing a patient with a pro forma can help with provision of information to the Driver and Vehicle Licensing Agency. Providing written information and advice (such as the leaflet on driving and dementia produced by the Alzheimer's Society[16]) is also advisable. Clinicians must make an immediate decision on whether the patient is fit to continue driving while further assessment is arranged. All

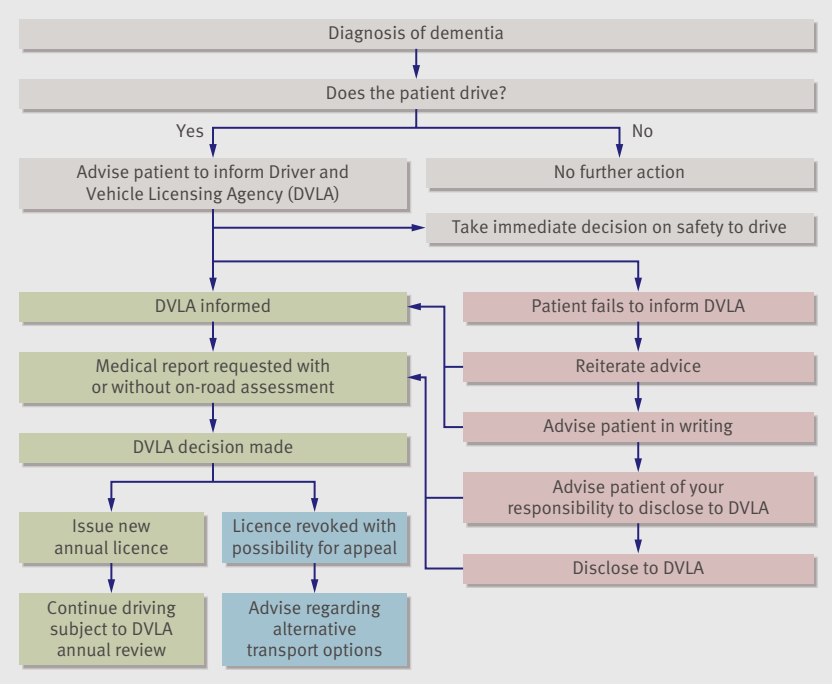
Summary of studies on crash risk in patients with Alzheimer's disease and other dementias

Study	Study design	Methods	Outcome measure of risk	Crash risk or main findings
Carr et al 2000[6]	Retrospective case-control	63 patients with Alzheimer's disease versus 63 elderly controls	State recorded traffic crashes over five years	No statistical difference in crash rate between groups, although Alzheimer's disease group had trend towards more crashes being ascribed to their fault, crashes with injuries, and crashes in which officer at scene cited "failure to yield"
Cooper et al 1993[2]	Retrospective case-control	165 patients with dementia (not specific for Alzheimer's disease) versus 165 population controls (stratified random sample)	Incident data from official records in British Columbia	26.1% of patients with dementia had one or more crashes compared with 11.5% of controls. Over 80% of patients with dementia continued to drive after crashes for up to three years, and during this time over one third had at least one more crash
Drachmann et al 1993[7]	Retrospective case-control questionnaire	130 carers of patients with "possible or probable Alzheimer's disease" versus 112 age matched controls	Frequency of crashes (total crashes and crash rates per year)	Significant increase in crash rate in dementia group compared with controls over whole course of the illness (0.91 per year compared with 0.40). Crash risk acceptably low until around three years after disease became clinically apparent, increasing linearly thereafter
Dubinsky et al 1992[8 9]	Retrospective case-control interview and questionnaire	67 patients with Alzheimer's disease and families versus 100 elderly controls	Number still driving and crash rates after three years' disease duration (based on crashes per mile driven)	28.4% of Alzheimer's disease group were still driving compared with 98% of controls. Patients in Alzheimer's disease group still driving had 263.2 motor vehicle crashes per million miles compared with 14.3 in the control group
Fitten et al 1995[10]	Prospective case-control study	24 patients with dementia (Alzheimer's disease and multi-infarct dementia) versus 57 controls (aged matched older participants, young participants, and age matched patients with diabetes without history of stroke or dementia)	Sulveda road test score, cognitive test battery, and authority recorded collisions	Significant negative correlation between drive score and collisions or moving violations. Alzheimer's disease group drove more slowly, had lower mean drive scores, and committed more errors in the complex stages of the test course than the three control groups
Friedland et al 1988[5]	Retrospective case-control questionnaire	30 patients with Alzheimer's disease versus 20 healthy age matched controls	Frequency of motor vehicle crashes in previous five years as reported by spouse or family	47% of Alzheimer's disease group had incurred at least one crash while driving compared with 10% in control group
Gilley et al 1991[4]	15 item questionnaire	522 consecutive patients at a dementia clinic. No controls	Crashes in past six months reported by primary caregiver, ticketed moving violations, and specific incidents observed by informant	33% of Alzheimer's disease group had at least one form of unsafe motor vehicle operation, of whom 22% had motor vehicle crashes
Lucas-Blaustein et al 1998[1]	Questionnaire	53 referrals to dementia clinic (53% Alzheimer's disease, 8% multi-infarct dementia, 4% mixed, and 8% other dementia). No controls	Crashes since onset of disease, reported by caregivers or informed relatives	33% of patients had crashed since onset of disease. 11% were reported to have caused the crashes
Trobe et al 1996[11]	Retrospective case-control	143 patients with Alzheimer's disease versus 715 age matched and sex matched controls	Crash rates per driver years from state records and caregiver reports	No significant difference in annual crash rate
Tuokko et al 1995[3]	Retrospective case-control	249 patients with Alzheimer's disease versus 249 age matched and sex matched controls	Crash rates from state records	Patients with Alzheimer's disease had 2.5 times crash rate of controls
Zuin et al 2002[12]	Retrospective case-control	56 caregivers of patients with dementia versus 31 elderly driver controls	Abnormal driving behaviours and collisions based on interview with informants.	36% of patients with dementia exhibited abnormal driving behaviours compared with 22% of controls. 20% of patients with dementia had a crash compared with 6% of controls. 12% of patients with dementia had multiple crashes compared with 0% of controls

decisions and actions should be documented in the patient's notes.

It is important to advise patients and their families on an individual basis of the predicted decline in driving ability, although three years from when the disease becomes clinically obvious may be reasonable. This allows patients to plan for when they stop driving and to look for alternative transport options. This in itself is a compelling reason to share the diagnosis of dementia with a patient who drives. Many older people do not, however, consider public transport to be adequate or efficient and often see it as a threat to their security.[w19]

Clinicians should ask family and friends about specific incompetent driving behaviours such as driving the wrong way round roundabouts, getting lost in familiar areas, miscalculating speed and distances,



Clinical pathway for advice on driving after a diagnosis of dementia

and poor judgment. It has been shown that knowledgeable informants can detect dementia reliably and accurately, even in its early stages.[w20 w21] Family members can help patients realise that it is no longer safe for them to drive, but family may also have ulterior motives for maximising or, more usually, minimising driving difficulties, of which clinicians should be aware.

A doctor has a duty to inform the licensing authority if there is a reasonable likelihood of danger to other road users when patients will not or cannot inform the agency and continue to drive. Doctors should also check that patients are adhering to the guidelines.

Box 1 | Guidelines from the Driver and Vehicle Licensing Agency if medical conditions could affect safe driving[15]

Age

- Age is no bar to the holding of a driving licence
- Licences are normally valid until age 70, unless restricted to a shorter duration for medical reasons
- The agency requires confirmation at age 70 that no medical disability is present
- All licence applications require a self declaration of medical status by the applicant
- The maximum licence period after age 70 is three years, subject to satisfactory completion of medical questions on the application form

Dementia

- The agency must be notified as soon as Alzheimer's disease or another dementia is diagnosed
- Drivers have an obligation to make such a declaration
- The agency accepts the difficulty of assessing driving ability in Alzheimer's disease
- Patients with poor short term memory, disorientation, and lack of insight and judgment are almost certainly not fit to drive
- In early Alzheimer's disease, where sufficient skills are retained and disease progression is slow, a licence may be issued subject to annual review
- A formal driving assessment may be necessary
- A decision on fitness to drive is usually based on medical reports

How does the Driver and Vehicle Licensing Agency make its decision?

When the Driver and Vehicle Licensing Agency is informed of a diagnosis of dementia a medical adviser requests a report from the relevant doctor. The completion of the report may be aided by input from a specialist in old age psychiatry, geriatrician, or neurologist. For this reason many general practitioners refer patients to specialists in the early stages of disease. Some psychiatrists believe that the forms provided by the Driver and Vehicle Licensing Agency are unsatisfactory.[w23] Difficulties can also arise because completion of the form usually takes place at the time of diagnosis and before the effects of treatment have been established. Depending on the information received, the agency may issue a new licence valid for one year (subject to annual review) or revoke the licence (with the possibility for appeal). A slow response from the agency may mean that patients continue to drive for months before the decision is made.

The agency's medical adviser may request an on-road driving assessment of the patient. This is generally seen as the ideal means for assessing an ageing driver.[w24] The patient is assessed on a predetermined test route in a vehicle with dual controls. Among other things, the patient is graded on sense about road position, response to road signals, and awareness of other road users (Scottish Driving Assessment Centre, personal communication, 2006). Although drivers with dementia tend to perform at significantly lower levels in this type of test,[w25] a significant minority will perform at an acceptable level. The main drawback of on-road testing is the geographical spread of the 17 testing centres in the United Kingdom, although the numbers are increasing (Driver and Vehicle Licensing Agency, 2006).

Patients with dementia must also inform their insurance company of their diagnosis. Failure to disclose this information may invalidate their policy. The Association of British Insurers has advised that, provided the Driver and Vehicle Licensing Agency is satisfied that someone with a diagnosis of dementia is fit to hold a licence, then he or she should be treated no differently from an applicant without a disability or disease (Association of British Insurers, personal communication, 2006). This situation may change with the accumulation of actuarial data.

What is the role of cognitive function testing?

Clinicians can carry out a variety of clinical, cognitive, behavioural, and activities of daily living tests to

A medical perspective

A 73 year old man presented to the local adult psychiatric service in June 2000 with a six month history of concentration problems and difficulties with short term memory. His family had a strong history of Alzheimer's disease in later life. He scored 26/30 on the mini-mental state examination, losing points for orientation and immediate recall. He had no agnosia or topographical disorientation. Evidence was insufficient to diagnose dementia.

He presented to the memory clinic again in August 2001, by which time his short term memory loss had progressed and he relied heavily on his diary and his wife for daily living. He was unable to manage his finances and had grossly impaired numerical skills. He continued to sail his boat, but always with the support of an experienced sailor. His score on the mini-mental state examination was now 23/30. A diagnosis of Alzheimer's disease was made and he was given donepezil 5 mg daily. He continued to drive, which his wife thought he did competently. He was informed of his legal obligation to inform the Driver and Vehicle Licensing Agency of his diagnosis.

When he was seen at the memory clinic in December 2001 he was still driving. No concerns were expressed by his family about his driving ability. He had failed to contact the Driver and Vehicle Licensing Agency as advised.

The patient was advised of his responsibility to inform the Driver and Vehicle Licensing Agency both verbally and in writing. He eventually informed the licensing agency in April 2002. In May 2002 his mini-mental state examination score was 21/30. In June 2002 the medical report from a consultant psychiatrist indicated that the patient had evidence of cognitive impairment and significant loss of judgment. The report also mentioned that the patient had driven into a kerb and punctured a tyre. His licence was withdrawn by the Driver and Vehicle Licensing Agency.

The patient's wife complained to the licensing agency in late July 2002, after the couple decided that the decision was "ridiculous."

The patient appealed against the decision. In August 2002 he was granted a provisional disability assessment licence to allow an on-road driving assessment to be completed. In June 2003, 22 months after the diagnosis of Alzheimer's disease, the patient received an appointment for an on-road driving test, which he failed.

accurately complete the Driver and Vehicle Licensing Agency report, and these tests are well described in the literature.[17 18] Although statistically significant differences in cognitive function testing have been shown between dementia groups and controls, overlap between group scores make these tests unusable. This reflects in part the differences in the cognitive deficits between dementia subtypes, a failure to observe and examine these separately in research studies, and great variability in the presentation and course of the dementias. Indeed it is reasonable to say that few, if any, of the tests have any congruence with modern thinking on models of driving behaviour.[w28 w29] For these reasons the British Psychological Society has stated that "no one test, or sets of tests, can as yet be recommended for off-road assessment."[19] A recent systematic review of cognitive tests that might be used in clinical settings found that no tests (not even clock drawing or trails B tests recommended by the American Medical Association[20]) are robust enough to be used in clinical practice other than to assist in determining the need for further evaluation of driving.[18] Even the mini-mental state examination is of little value in drawing fine distinctions between patients with early Alzheimer's disease for capacity to drive safely.[5]

Relicensing for drivers with dementia in the European Union and North America

The European Council directive 91/439/EEC sets out the minimum standards of physical and mental fitness to drive at any age. It makes no specific reference to dementia and so interpretation varies significantly between member states. The subject of relicensing was comprehensively investigated in 2000, with all 15 contemporary EU members surveyed.[21] The United Kingdom was the only EU country in which patients had an obligation to inform their driving authority when an illness was diagnosed that may affect driving ability. A system that relies heavily on self reporting can face difficulties in conditions such as dementia where patients are unaware of their compromised driving ability.

State governments in the United States have a variety of methods for increasing the stringency of the licensing process for older people, including the adoption of in-person renewal requirements, vision tests, road tests, and a shorter renewal period.[w36 w37] In Canada most states have mandatory reporting requirements.[w22]

Conclusions

Some patients with early dementia are capable of driving safely. The three year rule, which broadly states that with regular review the risk of crashes in patients with Alzheimer's disease is acceptably low for up to three years after the disease becomes clinically apparent, has been proposed as a means of guiding relicensing policy. Whatever the relicensing rules, doctors in the United Kingdom must ensure that the Driver and Vehicle Licensing Agency is informed of all new diagnoses of dementia. They must also adequately complete a medical report, on which the licensing agency will base its decision on fitness to drive. The challenge for doctors and the licensing agency is to balance mobility and safety in the growing proportion of older people in the population. To this end the UK Department of Transport is to launch a public consultation to consider changes to relicensing. Current evidence from Scandinavia, Australia, and the United States, however, suggests that mass medical screening or cognitive screening of older drivers has negative consequences for public health.[22-24] Therefore the main thrust of future measures should focus on opportunistic screening of high

SUMMARY POINTS

Many people with early dementia are capable of driving safely

Evidence suggests that the risk of crashes in drivers with dementia is low for up to three years after disease onset, but this varies between people

The Driver and Vehicle Licensing Agency must be notified of all new diagnoses of Alzheimer's disease and other dementias: this relies primarily on self reporting

The doctor's role is to make an immediate decision on safety to drive and to ensure that the licensing agency is notified

Cognitive testing cannot determine whether individuals with early dementia are able to drive safely

The challenge for doctors and the licensing agency is to balance mobility and safety in a growing population of older drivers

risk populations, such as those attending memory clinics, and the refinement of effective pathways for clinicians and the Driver and Vehicle Licensing Agency to manage mobility and safety,[w35] a position recently adopted by the House of Lords Science and Technology Committee.[w38]

We thank the patient who consented to his case study being published, Eric Wood for his support and advice, the Driver and Vehicle Licensing Agency and Department of Transport for their assistance, and the medical illustration department at the Royal Infirmary of Edinburgh for formatting the original clinical pathway diagram.

Contributors: DAB carried out the literature review, constructed the table, and wrote the paper. He will act as guarantor. DPB wrote and edited the paper and constructed the clinical pathway. JWM wrote the section on cognitive function testing. PAB initiated the paper and wrote the case study. DO'N had considerable input into all stages of writing the paper.
Competing interests: None declared.
Provenance and peer review: Not commissioned; peer reviewed.

ADDITIONAL EDUCATIONAL RESOURCES

Patient and carer information

Alzheimer's Society (www.alzheimers.org.uk/After_diagnosis/Driving_and_travelling/info_driving.htm)—Advice and contact details for Driver and Vehicle Licensing Agency and driving assessment centres

Alzheimer Scotland (www.alzscot.org/pages/info/driving.htm)—Advice on rules of driving with dementia, transport options, and contact details, including dementia helpline

Driver and Vehicle Licensing Agency (www.direct.gov.uk/en/Motoring/index.htm)—Rules on licensing and updating licences

Forum of mobility centres (www.mobility-centres.org.uk)—Location and functions of the 17 UK driver assessment centres

Assessment of medical fitness to drive

General Medical Council. Confidentiality: protecting and providing information. 2004. www.gmc-uk.org/guidance/archive/library/confidentiality-faq.asp

Drivers Medical Group (www.dvla.gov.uk/media/pdf/medical/aagv1.pdf)—Regularly updated state of the art and practical guides to driving

Carter T. *Fitness to drive: a guide for health professionals*. London: RSM Press, 2006—Published on behalf of the Department for Transport and in association with the BMA

Canadian Medical Association (www.cma.ca/index.cfm/ci_id/18223/la_id/1.htm)—Up to date advice, with driving and dementia toolkit

American Medical Association (ww.ama-assn.org/ama/pub/category/10791.html)—Guide for physicians on assessing and counselling older drivers

Older people and transport

Transportation Research Board (www.gulliver.trb.org/publications/conf/reports/cp_27.pdf)—Overview of all aspects of transport in older people, with emphasis on North America

Organisation for Economic Co-operation and Development Working Group ERS4. *Ageing and transport: mobility needs and safety issues*. Paris: OECD, 2001—Good overview of policy and research agenda for older people and transport

Charlton JL, Koppel S, O'Hare M, Andrea D, Smith G, Khodr B, et al. Influence of chronic illness on crash involvement of motor vehicle drivers. Report No 213. Monash, Vic: Monash University Accident Research Centre, 2004 (www.monash.edu/muarc/reports/muarc213.html)—Major review on influence of chronic illness and impairment in motor vehicle crashes

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Accepted: 23 April 2007