Synthesis title:

Fitness to Drive

Category: Drivers

Other Relevant Topics:

- Eyesight and Driving (Drivers)
- Drink Driving (Drivers)
- Drug Driving (Drivers)
- Older Drivers (Drivers)
- Fatigue (Drivers)
- Distraction (Drivers)

Keywords:

Fitness to Drive, Mental health and driving, Stress and driving, Medical conditions and driving, Dementia and Driving, Medical conditions and crash risk, Older drivers and hearing, Parkinson's disease and driving, Hearing and crash risk, Alzheimer's disease and driving, Epilepsy and crash risk, Hearing impairment and drivers, Stroke and driving

About the Road Safety Observatory

The Road Safety Observatory aims to provide free and easy access to independent road safety research and information for anyone working in road safety and for members of the public. It provides summaries and reviews of research on a wide range of road safety issues, along with links to original road safety research reports.

The Road Safety Observatory was created as consultations with relevant parties uncovered a strong demand for easier access to road safety research and information in a format that can be understood by both the public and professionals. This is important for identifying the casualty reduction benefits of different interventions, covering engineering programmes on infrastructure and vehicles, educational material, enforcement and the development of new policy measures.

The Road Safety Observatory was designed and developed by an Independent Programme Board consisting of key road safety organisations, including:

- Department for Transport
- The Royal Society for the Prevention of Accidents (RoSPA)
- Road Safety GB
- Parliamentary Advisory Council for Transport Safety (PACTS)
- RoadSafe
- RAC Foundation

By bringing together many of the key road safety governmental and non-governmental organisations, the Observatory hopes to provide one coherent view of key road safety evidence.

The Observatory originally existed as a standalone website, but is now an information hub on the RoSPA website which we hope makes it easy for anyone to access comprehensive reviews of road safety topics.

All of the research reviews produced for the original Road Safety Observatory were submitted to an Evidence Review Panel (which was independent of the programme Board), which reviewed and approved all the research material before it was published to ensure that the Key Facts, Summaries and Research Findings truly reflected the messages in underlying research, including where there may have been contradictions. The Panel also ensured that the papers were free from bias and independent of Government policies or the policies of the individual organisations on the Programme Board.

The Programme Board is not liable for the content of these reviews. The reviews are intended to be free from bias and independent of Government policies and the policies of the individual organisations on the Programme Board. Therefore, they may not always represent the views of all the individual organisations that comprise the Programme Board.

Please be aware that the Road Safety Observatory is not currently being updated; the research and information you will read throughout this paper has not been updated since 2017. If you have any enquiries about the Road Safety Observatory or road safety in general, please contact **help@rospa.com** or call **0121 248 2000**.

How do I use this paper?

This paper consists of an extensive evidence review of key research and information around a key road safety topic. The paper is split into sections to make it easy to find the level of detail you require. The sections are as follows:

Key Facts	A small number of bullet points providing the key facts about the topic, extracted from the findings of the full research review.
Summary	A short discussion of the key aspects of the topic to be aware of, research findings from the review, and how any pertinent issues can be tackled.
Methodology	A description of how the review was put together, including the dates during which the research was compiled, the search terms used to find relevant research papers, and the selection criteria used.
Key Statistics	A range of the most important figures surrounding the topic.
Research Findings	A large number of summaries of key research findings, split into relevant subtopics.
References	A list of all the research reports on which the review has been based. It includes the title, author(s), date, methodology, objectives and key findings of each report, plus a hyperlink to the report itself on its external website.

The programme board would like to extend its warm thanks and appreciation to the many people who contributed to the development of the project, including the individuals and organisations who participated in the initial consultations in 2010.

Key facts

- Medical conditions are a relatively minor risk factor in road traffic crashes, being reported as a contributory factor in 7% of fatal crashes and 3% of all reported crashes. (RRCGB, DfT, 2017)

- However, their prevalence as a contributory factor may be under-estimated in road accident data due to the difficulties in assessing whether those involved had a medical condition, and if so, whether it contributed to the crash or its consequences.

- Epilepsy is rated as a high-risk condition for crash involvement.

- Drivers with diabetes have a higher crash risk than those without diabetes, and the risk is even higher for diabetic drivers who are not taking medication for the disease.

- Drivers with either insomnia or obstructive sleep apnoea syndrome have a significantly increased crash risk compared with controls.

- The research evidence is inconclusive regarding the association between cardiovascular disease and crash risk.

- Heart disease is the most common cause of sudden death at the wheel, but not of acute collapses at the wheel (diabetes and epilepsy).

- Evidence is inconsistent regarding musculoskeletal conditions and crash risk but cognitive symptoms of multiple sclerosis are associated with increased crash risk.

- There is no significant association between hearing impairments and crash risk.

Summary

- Medical conditions are a relatively minor risk factor in road traffic crashes, being reported as a contributory factor in 7% of fatal crashes and 3% of all reported crashes. (RRCGB, DfT, 2017)

- However, their prevalence as a factor may be under-estimated in road accident data due to the difficulties in assessing whether those involved had a medical condition, and if so, whether it contributed to the crash or its consequences.

- Driving is a complex activity that requires a combination of physical and cognitive skills that can be adversely impaired by a wide range of fitness and health conditions.

- Drivers are personally legally responsible for ensuring that they are fit to drive, and informing the Driver and Vehicle Licensing Agency (DVLA) if they develop a condition that affects their fitness to drive.

- The DVLA sets minimum medical standards and rules for all drivers, including conditions that must be reported to the DVLA. The medical rules for Group 2 drivers (drivers of large vehicles over 3,500kgs, minibuses and buses) are more stringent than the rules for Group 1 drivers (cars and motorcycles).

- The DVLA assess over 700,000 fitness to drive cases each year, of which around 49,000 result in a licence being revoked or refused.

- Dementia impairs driving ability and can increase crash risk. However, in the earlier stages of the disease drivers often compensate by, for example, reducing or changing the type of driving they do.

- Epilepsy is rated as a high-risk condition for crash involvement.

- Drivers with diabetes have a higher crash risk than those without diabetes, and the risk is even higher for diabetic drivers who are not taking medication for the disease.

- Drivers with either insomnia or obstructive sleep apnoea syndrome have a significantly increased crash risk compared with controls.

- The research evidence is inconclusive regarding the association between cardiovascular disease and crash risk.

- Heart disease is the most common cause of sudden death at the wheel, but not of acute collapses at the wheel (diabetes and epilepsy).

- Evidence is inconsistent regarding musculoskeletal conditions and crash risk but cognitive symptoms of multiple sclerosis are associated with increased crash risk.

- There is no significant association between hearing impairments and crash risk.

METHODOLOGY

A description of the methodological approach to all of the research reviews on the Road Safety Observatory is available at http://www.roadsafetyobservatory.com/Introduction/Methods .

This review was compiled during December 2012 to February 2013. The steps taken to produce this review are outlined below. An update was compiled during April and May 2017. In December 2017, statistics from Reported Road Casualties Great Britain were updated to Reported Road Casualties Great Britain 2016.

Identification of relevant research

Searches were carried out on pre-defined research (and data) repositories. Search terms used to identify relevant papers included but were not limited to:

- Fitness to Drive
- Mental health and driving
- Medical conditions and driving
- Medical conditions and crash risk
- Parkinson's disease and driving
- Alzheimer's disease and driving
- Epilepsy and crash risk
- Stress and driving
- Dementia and Driving
- Older drivers and hearing
- Hearing and crash risk
- Hearing impairment and drivers

A total of 58 pieces of potentially relevant research were identified.

Initial review of research

This primarily involved sorting the research items based on key criteria, to ensure the most relevant and effective items went forward for inclusion in this review.

Key criteria included:

- Relevance: whether the research makes a valuable contribution to this synthesis, for example robust findings from a hospital-based study.
- Provenance: whether the research is relevant to drivers, road safety policies or road safety professionals in the UK. If the research did not originate in the UK the author and expert reviewer have applied a sense check to ensure that findings are potentially relevant and transferable to the UK.
- Age: Priority is given to the most up to date titles in the event of over-lap or contradiction, although older research papers are included because much of the fundamental research took place as seat belts were being developed and used.
- Effectiveness: whether the research credibly proves (or disproves) the effectiveness of a particular road safety initiative or intervention.

Following the initial review, 26 pieces of research were taken forward to form the basis for this synthesis, 6 of which were published in the UK.
In addition, 41 pieces of research were added in the update phase, 8 of which were published in the UK.

Detailed review of research

The medical conditions reviewed, based on the availability of evidence pertaining to road crash risk, include mental health, neurodegenerative disorders, diabetes, epilepsy, sleep disorders, cardiovascular disease, Multiple sclerosis, musculoskeletal impairments and hearing impairments.

Key facts, figures and findings were extracted from the identified research to highlight pertinent road safety issues and interventions. A high proportion of the research used in this review derives from outside of the UK, but has been included because it is relevant to UK road safety.

KEY STATISTICS

Driving is a complex activity that requires a combination of physical and cognitive skills that can be adversely impaired by a wide range of fitness and health conditions. These conditions can affect the driver's performance and increase their crash and/or injury risk.

A condition that impairs perception, cognition (including alertness, attitude to risk, or memory) or motor function has the potential to impair a person's ability to drive safely. It may be constant (such as a vision defect), episodic (such as a sudden loss of consciousness), or temporary (such as a severe cold or migraine). It may be a condition that becomes worse over time, such as a neurological disease.

The DVLA sets minimum medical standards and rules for all drivers, including conditions that must be reported to the DVLA. The medical rules for Group 2 drivers (large vehicles over 3,500kgs, minibuses and buses) are more stringent than the rules for Group 1 drivers (cars and motorcycles).

Drivers are legally responsible for ensuring that they are fit to drive, and in some circumstances informing the Driver and Vehicle Licensing Agency (DVLA) if they develop a condition that affects their fitness to drive. A driver may have their licence refused or revoked if the DVLA considers they are a likely source of danger to the public when driving because of a health problem that affects their fitness to drive.

A list of health conditions that may require drivers and motorcyclists in the UK to report to the DVLA is available at https://www.gov.uk/health-conditions-and-driving. The DVLA's "*At a Glance Guide to the Current Medical Standards of Fitness to Drive*", available free athttp://www.dft.gov.uk/dvla/medical/aag.aspx, also outlines the conditions that must be reported.

Drivers and motorcyclists can be fined up to £1,000 if they do not tell DVLA about a medical condition, including eyesight problems, that affects their driving. They may also receive penalty points or be disqualified from driving. The penalties for continuing to drive after being refused a licence or having a licence revoked on medical grounds include a possible prison sentence of up to six months, penalty points or disqualification and a fine of up to £5,000.

Not all reportable medical conditions will result in a licence being revoked or refused. Some drivers may be granted a restricted licence that is valid for up to three years, after which they must re-apply for their licence. Others may be unaffected provided that they are managing their condition appropriately. The DVLA assesses over 700,000 fitness to drive cases each year, of which around 49,000 result in a licence being revoked or refused.

Road Accidents and Casualties Caused by Health Problems

Medical conditions do not appear to play a major role in crash risk or crash responsibility. Well known crash causation factors, such as night time driving, being male and aged less than 25 years, alcohol consumption and riding motorcycles are more common risk factors (Carter 2006, Hours et al 2008). However, many conditions do impair driving, as detailed in this review.

It is very difficult to obtain reliable estimates of crash risk, or number of crashes, involving drivers who have, or were impaired by, specific health problems because road accident data does not normally include information about the medical status of those involved, and indeed it would be very difficult for it to do so.

In 2016,"illness or disability, mental or physical" was reported as a contributory factor in 108 (7%) reported fatal road accidents, 559 (3%) reported serious road accidents, and 2,240 (2%) reported road accidents in total (see Table 1). These accidents resulted in 115 people being killed, 697 being seriously injured and 2,643 road casualties in total (see Table 2). (RRCGB, DfT, 2017)

Contributory factors are largely subjective, reflecting the opinion of the reporting police officer, and are not necessarily the result of extensive investigation, and subsequent enquiries could lead to the reporting officer changing his/her opinion. (DfT, 2011)

Table 1: Contributory Factors in Reported Road Accidents in Great Britain in 2016 (RRCGB, DfT, 2017)

	Fatal	**Serious**	**Slight**	**Total**
Illness or disability, mental or physical	108 (7%)	559 (3%)	1,573 (2%)	2,240 (2%)

Table 2: Contributory Factors in Reported Road Casualties in Great Britain in 2016 (RRCGB, DfT, 2017)

	Fatal	**Serious**	**Slight**	**Total**
Illness or disability, mental or physical	115 (8%)	697 (4%)	2,236 (2%)	2,643 (2%)

Health professionals play a key role in mitigating health-related impairment and so reducing the risk of crashes, while enabling as many people as possible to stay safely mobile. There are many options for address fitness to drive problems:

- Self-regulation (for example, drivers compensate for the impairment by changing when, where and how they drive, such as not driving at night)
- Restricted licences (for example, a licence being valid for only three years; in some countries, the driver is not permitted to drive in certain situations, such as at night)
- Medical treatment to address the cause of the problem (for example, medication or surgery).
- Stopping driving, either for a temporary period or permanently
- Driver rehabilitation training to help the driver cope with the impairment
- Driver education to help the driver understand the effect of the impairment
- Vehicle adaptation (for example, modified controls to enable the driver to drive with their impairment)

ASSESSMENT TOOLS AND MEASURES OF FITNESS TO DRIVE

Assessing fitness to drive is a very complex task and presents distinct challenges according to the different aspects that can impair a person's cognition, vision, perception, physical or psychological ability to drive. Most of the time, complex tools, and joint work between medical specialists and on-road assessors are needed in order to obtain reliable assessment results.

This first chapter presents some general findings and considerations for measures and tools of assessment of fitness to drive. The following chapters will also present some tools and their results for specific aspects.

In relation to cognitive impairment, research suggests that there is a need for standard care pathway adopted in clinical settings, and a protocol for GPs and other health professionals to discuss fitness to drive with their patients; also, research is needed into developing a clinically viable desk based assessments of driving safety (Carsten, *et al.*, 2016). The same authors raise the issue of commissioning research to look in more detail at any potential associated risks for safe driving manifested by prescription medicines. The DRUID project (Ravera, *et al*., 2012) categorizes 1,541 medicines in three levels:

- Level 0 (no or negligible influence on fitness to drive) – 57%
- Level I (minor influence on fitness to drive) – 26%
- Level II (moderate or severe influence on fitness to drive) – 17%.

Before evaluating the assessment tools and measures for fitness to drive, researchers need to raise the question of how well are the rules known by medical specialists (Carsten, *et al.*, 2016). In an audit to find out how well ENT (Ear, Nose and Throat) surgeons in Wales know the legal rules for fitness to drive, research found that all respondents were aware that it is the patient's responsibility to inform the DVLA (Driver and Vehicle Licensing Agency) regarding their medical condition, but 53% of the respondents were not aware that patients need to inform the DVLA if they suffer with day time sleepiness, and only 37% discuss driving when patients are seen in clinic with vertigo (Yap, *et al*., 2017).

In another study, most specialists were found to report that fitness to drive is an important issue in their practices, but their confidence in their ability to assess fitness to drive was low and they felt they would benefit from further education (Marshall, *et al.*, 2012)

In Ireland, GPs are confident or very confident in assessing the medical fitness to drive (MFTD) guidelines and they also show a high level of awareness of the new guidelines (Kahvedzic, *et al*., 2014). On the other hand, another study looking at clinical effectiveness in assessing fitness to drive of medically at-risk older adults found that judgements of disease severity, decrements in driver insight, and older age influence clinician ratings of driving capability (Meuser, *et al*., 2016). Therefore, particular attention needs to be given to the assessment process and tools.

Looking at the assessment process, a literature review research on screening and assessment tools for determining fitness to drive created 10 tables, organised into groups of key research studies. Each table has a summary of important concepts. This way, readers can better understand the research. They are also encouraged to use the reference tables to explore options since an assessment tool may be the best choice in one clinical setting but may not be the most informative choice in another setting (Dickerson, 2014). In another study in Canada, following the development of Fitness-to-Drive screening measures, the authors listed a series of barriers to older driver fitness to drive decisions, and a comprehensive set of resources and recommendations were identified (Classen, *et al*., 2016).

Some research developed and evaluated tools to assess fitness to drive. The Montreal Cognitive Assessment (MOCA) screening tool was found to give clear cut-offs for people who are more likely to pass (MOCA>27) and for people more likely to fail (MOCA<12) the on-road driving assessment. This suggests that MOCA could potentially be used as a quick cognitive screen for health practitioners (Esser, *et al*., 2015). Another toolkit based on cognition measures, was also developed in China for assessing coach drivers' fitness to drive (Wang, *et al*., 2016)

Even if found to be effective, special consideration needs to be given when using assessment tools since other research suggest that a single tool measuring cognition, vision, perception, or physical ability individually is not sufficient to determine fitness to drive; the research suggests using different and focused assessment tools together for specific medical conditions and that behind-the-wheel assessment remains the gold standard (Dickerson, *et al*., 2014). Other research also supports the effectiveness of off-road skill-specific training and computer-based driving simulator training for drivers' rehabilitation (Unsworth and Baker, 2014). Research of visual-cognitive tools used to determine fitness to drive advise caution since results suggest that test scores may in some cases reflect age-associated normal biological changes (Bedard, *et al*., 2016)

Although difficult, fitness to drive needs to be assessed. Standard pathways and protocols seem to come into place and to create the appropriate settings for health, medical and safety practitioners to address and assess the subject.

MENTAL HEALTH AND FITNESS TO DRIVE

Mental health is an important aspect of fitness to drive. Injury can be both a consequence and a cause of mental ill health.

Poor mental health status, such as symptoms of depression, anxiety, insomnia, and social dysfunction are associated with poor driving behaviour (Abdoli, *et al*., 2015).

There are several issues with assessing the relationship between mental health and fitness to drive. It is hard to define objective criteria that form the difference between having a mental health condition or not. When assessing the relationship between crash risk and mental health, many studies do not distinguish between any excess risk due to the condition, and due to any medication that may be taken to treat it.

Moreover, later research underlines the need for organisational level changes in the practice of assessing fitness to drive instead of relying on individual psychiatrists' practices. One clinical audit demonstrated the need to improve awareness among mental health teams that they have a role, though indirectly, with regard to their patients' fitness to drive (Yaqub, *et al*., 2016).

It is sometimes hard to make "like for like" comparisons between people with and without many conditions, such as Alzheimer's disease. For example, many drivers reduce the amount of driving they do at early onset of the disease (self-regulation), which makes it difficult for research studies to be certain that similar mileages are covered by both the drivers with the disease and the control groups of drivers without it.
For assessing fitness to drive in patients with cognitive impairment, research suggests that a combination of neuropsychological test performance and simulated driving behaviour is a valid predictor of practical fitness to drive (Fuermaier, *et al*., 2017).

Psychiatric illness
There are several impairments due to psychiatric illness that can affect driving ability, such as impaired information processing, reduced attention, poor impulse control and poor judgement to predict and anticipate. Medication can alleviate some of these risks, but also create risks in itself. (Carter 2006)

The rates of adverse driving events, such as crashes, amongst drivers licensed in Utah with and without a reported medical condition on their driving licence were compared (Vernon et al 2002). In Utah, 6,418 of the 1,750,918 licensed drivers were registered with a psychiatric medical condition. The drivers with psychiatric conditions had a crash rate of 2.24 per 10,000 licence days compared with a rate of 1.43 per 10,000 licence days amongst drivers who were not registered with a psychiatric medical condition. This difference was unlikely to be due to chance.

The weaknesses of this study are that many drivers would report multiple medical conditions, which may have influenced the strength of this relationship. Many drivers with medical conditions may self restrict the amount of driving that they do, and so measuring crashes per licence days rather than miles actually driven may also influence the strength of this relationship.

Stress
Studies examining the role of stress in traffic crashes have focused predominantly on occupational settings and posttraumatic stress disorder.

There is some evidence that driving for work is seen as more stressful than driving for personal reasons. A survey of 201 drivers from a range of organisations and sectors found that 35% of them found driving for work stressful, compared with 15% who reported driving outside work stressful. 61% of respondents identified that they often perceived time pressures when driving for work, compared with only 25% who felt time pressures in their personal driving. (O'Dolan and Stradling, 2006)

Occupational stress has been linked with the risk of accident involvement. A retrospective study of 236 drivers compared work-related stress between drivers involved in an accident and drivers who had not had an accident. Accidents from the previous three years that had been reported to the fleet insurance broker were used to identify cases; drivers uninvolved in accidents were used as the control group. Poor time management, lack of social support, poor managerial responsibility, job dissatisfaction and stress about the home/work balance were all associated with accident involvement. (Cartwright, Cooper and Barron, 1996)

In a study on the Chinese Driver Stress Inventory tool, research had found that stress was strongly correlated with dangerous driving behaviour. Also, female drivers had higher scores for disliking driving and fatigue proneness and lower hazard monitoring scores (Qu, *et al*., 2016).

Positive association was found between global stress and anger, and anger was found to mediate the effect of global stress on both negative cognitive/emotional driving and aggressive driving behaviour (Ge, *et al*., 2014).

Posttraumatic stress disorder was found to be significant in increasing subjective and physiological sleepiness, which were found to decrease attention tasks and reactions (Schwartz, *et al*., 2016).

Other studies have examined the interrelationship between occupational stress, safety climate and risk of fatigue related injury. 219 drivers from two government organisations completed questionnaires to assess both occupational stress and safety culture, and also questions on self-reported near miss events from the previous six months. Occupational stress and safety culture both predicted fatigue-related behavior and accounted for 29% of the variance in fatigue related behaviour. The weaknesses in this study were the use of self report near miss data, and the lower response rate than was expected following similar surveys. (Strahan, Watson and Lennon, 2008).

Later research suggests that there are particular responsibilities for employers in insuring the fitness of their employees to drive and that a central government agency or department should take responsibility in this crucial area (Carsten, *et al*., 2016)

Depression

Generally, for mild anxiety and depression without severe problems or memory problems, agitation, behavioural disturbance or suicidal thoughts, the condition is unlikely to increase the risk of injury, although there may be side effects from some medications taken to treat it. Drivers of large vehicles may be required to notify the licensing authority for conditions or treatments lasting over several weeks.

Severe depression can increase the risk of suicide, and requires consideration from medical professionals. Driving should usually be suspended until treatment has stabilised the condition (Carter 2006)

A review of 13 studies (conducted in several different countries, but not in the UK, during different periods between 1967 and 1999) that examined the percentage of traffic fatalities that were due to suicide (found that the estimated proportion of suicides in all crashes ranged from 14.3% to 0%, with most studies finding that the proportion was between 1% and 3%. The authors stress the difficulties in establishing whether a crash was intentional or not, and that often coroner's courts record open verdicts. (Routley et al, 2003)

Substance use disorders

A study compared 61 young male driver fatalities in traffic crashes with a control group matched on age with the accident group (Dumais et al 2005). Several people diagnosed psychiatric conditions using the psychological autopsy method, and the reliability of these diagnoses were confirmed statistically.

Substance misuse disorders in the previous six months were over 11 times more likely in the fatally injured drivers over 26 years old, although the confidence interval at 95% ranged from 2.12 to 112.13. This difference was not seen in drivers under 25 years old. However, for many diagnoses, there were not enough participants to be able to confirm that the differences between the fatalities and control group were not due to chance.

Further details about drugs and driving are available in the Road Safety Observatory's "Drugs and Driving" research review.

Wellbeing

There has been increasing interest in the relationship between positive mental wellbeing and health. Tools such as the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS) that use positive questions about wellbeing have been validated to measure this construct. (Tennant et al, 2007)

No studies were found assessing the association between wellbeing and crash risk.

PHYSICAL HEALTH AND FITNESS TO DRIVE

Neurodegenerative Disorders

Dementia

Dementia can change cognitive performance by leading to slower response times and worsening memory. Some common driving problems are:

- Forgetting familiar routes
- Confusion between pedals
- Complex situations may cause an individual to stop when there is no need
- Failure to give way
- Slow response to directions or instructions (Carter 2006)

Looking at driving errors in persons with dementia, a recent study found that:

- 62% of individuals with dementia failed the road test, in comparison to only 3% of the individuals in the control group
- Individuals with dementia commit twice as many driving errors as the healthy control
- Within the dementia sample, individuals who failed the road test had more difficulties driving straight and making left and right turns
- Usual difficulties for persons with dementia included lane positioning, lane usage, stopping the vehicle appropriately, attention, decision-making, and following rules of the road

The finding that the most of dangerous actions in the sample with dementia occurred while driving in straight conditions is novel and has potential implications for interventions related to driving recommendations for people with dementia (Barco, *et al*., 2015).

There are several tests that can be used to understand the level of cognitive impairment due to dementia. The Mini-Mental State Exam (MMSE) and Clock Drawing Test are commonly used.

A systematic review looking at cognitive tests for determining fitness to drive in dementia found lack of consistency in the findings. Individual cognitive tests and measures confined to a single cognitive domain were variable and not consistently associated with driving performance. Scores on individual tests or tests of a single domain did not predict driver safety. Composite batteries, although they predict driving performance better than single tests, were found not to be clinically usable because they lack the ability to discriminate sufficiently between safe and unsafe drivers. Researchers underline the need to develop a reliable, valid composite battery that can correctly determine driver safety in individuals with dementia (Bennet, Chekaluk and Batchelor, 2016).

Other research also found concurrent validity between two assessment tools, the Rookwood Driving Battery (RDB) and the Dementia Drivers' Screening Assessment (DDSA) tool and raise questions about the choice of assessment in making clinical recommendations about fitness to drive in people with dementia (Vella and Lincoln, 2014).

Looking at agreements between physicians and on-road assessors regarding fitness to drive recommendations in individuals with dementia, research found low agreement between the two categories, with physicians overestimating the fitness to drive for patients who incurred more traffic violations. Research suggests effort be made to improve the communication between physicians and on-road assessors for joint decision making of fitness to drive in dementia (Ranchet, *et al*., 2016).

Similar suggestions are given in research regarding general mental health professionals, of combining clinical assessment, cognitive tests and on-road driving tests to provide the most accurate assessment of driving ability. Clinicians alone were found generally unable to predict driving ability accurately. Similarly, individual cognitive tests alone did not provide reliable assessment of driving safety. Composite tests of memory, attention, visuo-spatial and executive function may assist in the assessment of driving safety, but there is no consensus on cut-off scores relevant to driving (Allan, *et al*.,2016).

Other research also suggests that general practice occupational therapists must work in conjunction with driver rehabilitation specialists for better fitness to drive assessments; the author provides a framework for referral and judgement and resources for practitioners to use (Dickerson, 2013).

By integrating the latest guidance, a potentially generalizable pathway that reflects up-to-date policy and encompassing differing perspectives and good practices for driving with dementia, and which can be easily adaptable for use internationally is suggested in the UK to replace local regulations (Carter, *et al*., 2014).

The medical records of drivers licensed in Utah were used to study the increased driving risk related to learning, memory or communication and/or cognitive defects. This category includes persons with Alzheimer's disease. The crash and at-fault crash rates of 107 drivers in this category were compared with drivers without any registered medical condition. 732 drivers were licensed in both this category and at least one other; and so were excluded from this particular comparison. Separate comparisons were made for drivers with and without restrictions on their licence, which included legal restrictions on when and where they could drive.

When measuring crashes per 10,000 licence days, drivers with impairments in learning, memory or communication and/or cognitive defects, but who did not have restrictions on their licence, were 2.19 times more likely to be involved in a crash and 3.32 times more likely to be legally responsible for causing a crash than drivers who were not suffering from these conditions. These findings were unlikely to be due to chance. (Diller et al, 1999)

A study on the relationship between dementia and traffic injury was conducted using participants of the Three Cities cohort in France. 2,104 participants were recruited from the cohort and assessed by a psychologist and neurologist to evaluate their risk of dementia. Self reported driving activity was also recorded. The authors found that dementia was a major factor in driving cessation, and was 14 times more common in participants who had given up driving, and that the participants who had ceased driving were more impaired than those who had continued. (Lafont et al, 2008)

Whilst increased age also resulted in an increased crash risk amongst the participants, the study did not identify an association between dementia and crash risk, potentially due to self-restriction or cessation. (Lafont et al, 2008)

Given the conflicting results on the relationship between Alzheimer's disease and crash involvement, a systematic review was conducted. 218 studies were initially identified, 14 of which were relevant to the research question. These studies provided data on increased crash risk, or evaluations of driving performance and driving tasks. As they had used different tests to identify dementia, the scores in all the studies were mapped against the Clinical Dementia Rating (CDR) scale.
The review concluded that patients who had a CDR score of 1 or greater had a substantially increased accident rate due to their increased number of driving performance errors. It recommended that driving should be discontinued at this level of impairment.

Patients with a CDR score of 0.5 to 1 had higher accident rates than drivers of a similar age without impairment, although the authors argue that the same rate is currently tolerated in other circumstances – for instance, young drivers with a legal level of alcohol. It was recommended that a driving performance evaluation should be considered in this circumstance, and that the appropriateness of driving should be kept under review given the high likelihood of progression to more severe dementia. (Dubinsky et al, 2000)

Aiming to develop a method to assess fitness to drive in a clinical setting for patients with Alzheimer's dementia, using three types of assessments, i.e. clinical interviews, neuropsychological assessment and driving simulator rides, a group of Dutch researchers found that all three types of assessments are predictive of on-road driving performance. Neuropsychological assessment had the highest classification accuracy followed by driving simulator rides and clinical interviews. However, combining all three types of assessments yielded the best prediction for fitness to drive in patients with AD with an overall accuracy of 92.7%, which makes this method highly valid for assessing fitness to drive in AD. This method may be used to advise patients with AD and their family members about fitness to drive (Piersma, 2016)

Analysing driving errors in Parkinson's disease (PD), research found that drivers with PD failed on-road tests to a greater extent than the healthy control drivers (41% compared to 9%) and that the driving errors predicting on-road pass or fail outcomes were made in visual scanning, signalling, vehicle positioning, speeding and total number of errors (Classen, *et al*., 2014).

A systematic review on the assessment tools for fitness to drive in patients with Parkinson's disease found that national guidelines that would establish risk assessment protocols involving multidisciplinary assessments are needed to assist physicians in making appropriate referrals for additional evaluations and recommendations when patients are deemed to be unsafe drivers (Jitkritsadakul and Bhidayasiri, 2016).

Tools such as the Rapid Paced Walk Test or the Modified Hoehn & Yahr can predict pass/fail outcomes on the road test. Others such as UPDRS motor scores did not predict safe driving. Therefore, researchers suggest that on-road testing is still the gold standard, and screening should always be followed by formal testing (Crizzle, *et al*., 2013).

Caregivers' risk impressions and Trail Making Test Part B was shown to be significant predictors of passing an on-road assessment. Research suggests that caregiver impressions, with a measure of set shifting, may be used as an efficient screen to identify drivers with PD who are potentially at risk for failing an on-road assessment (Classen and Alvarez, 2016).
Other research found that a clinical battery can be a valid screening tool to accurately identify fit drivers with Parkinson's disease and to select those who need more detailed testing at specialised centres (Devos, *et al*., 2013).
A small-scale study comparing the real-life driving of 27 drivers with Parkinson's disease (aged 57 to 82 years) with 20 matched drivers without the disease, fitted electronic monitoring devices into their vehicles for two weeks. The study found that drivers with Parkinson's disease restricted their driving to a greater extent than drivers without neurological disorders.

A greater proportion of the Parkinson's disease group preferred to drive with a passenger (48% versus 15%), and compared to 10 years ago, they were more likely to now drive less. On average, the Parkinson's disease group drove significantly fewer days, trips, stops, km and for shorter durations than the control group.

The authors noted that previous research has shown that progressive neurological disorders, such as Parkinson's disease, can compromise drivers' safe driving ability, which requires a combination of motor, visual spatial and executive skills (information processing, attention, quick decision-making).

Compared to drivers without neurological disorders, those with Parkinson's disease have more difficulty with operational and tactical manoeuvres such as maintaining lane position, turning, steering and speed control (Crizzle and Myers, 2013).

Although the symptoms associated with Parkinson's disease can affect driving ability in the early stages of the disease, some studies have found that the majority of subjects with Parkinson's disease were still competent drivers, possibly because they had modified their driving practices. (Crizzle and Myers, 2013)

The studies reviewed in this paper show that neurodegenerative diseases, such as dementia, Parkinsons and Alzheimer's, impair a driver's ability to drive safely and increase their crash risk. However, some of this increased risk is compensated for by the drivers concerned changing their driving habits (self-regulation), typically by reducing the amount they drive, and ultimately stopping driving altogether.

Multiple sclerosis

Multiple sclerosis (MS) is an autoimmune disease of the central nervous system. There are different categories of multiple sclerosis relating to the severity of symptoms.

The prevalence of multiple sclerosis in Western European countries is around 0.06% of the total population. (Charlton et al, 2010)

There is a lack of scientific evidence regarding multiple sclerosis and road crash risk. (Charlton et al 2010)

One study with a small sample size found that individuals with only physical symptoms of MS had no significant difference in crash risk compared with controls. However, individuals with *cognitive* symptoms of MS had a significantly greater risk of having one or more crashes than both the control group and the MS group with physical impairments only. (Schulteis et al, cited in Charlton et al 2010)

In a review of research evidence, multiple sclerosis was rated as having a moderately high overall crash risk. The crash risk rating of 'moderately high' was given when the relative risk data from the reviewed studies ranged between 2.1 and 5.0. MS was one of the eight medical conditions regarded as "high-risk" for crash involvement identified in a review of evidence from 2003-2009. (Charlton et al, 2010)
Studying the agreement between physician's recommendations and on-road assessors in fitness to drive decisions for patients with multiple sclerosis (MS), researchers found a good agreement rate of 88%, with the patients with poor binocular acuity being more likely to be inaccurately classified by the physicians. The research suggests that visual functions should be assessed in the doctor's office for more accurate referrals (Ranchet, *et al*., 2015).

Diabetes

Diabetes is a chronic condition that causes high blood sugar levels. There are two types:

- Type 1 diabetes is where the pancreas does not produce insulin, which is needed to regulate blood glucose levels. It has an early onset and usually first develops in the teens
- Type 2 diabetes is the most common form, and has a much later onset. With type 2 diabetes the pancreas does not produce enough insulin or the body does not respond to it.

Several conditions that can result from diabetes may impair driving, some of which (such as the increased risk of cardiovascular disease) are covered elsewhere in the review. Diabetes can also result in impaired vision, which is covered in the "Eyesight and Driving" review.

Hypoglycaemia can be a complication of insulin treatment, and can cause slower responses, impaired judgement of risk or loss of consciousness. The risk and seriousness of an episode can vary widely and is currently hard to predict. (Carter 2006)

Several studies have examined the risk of injury and diabetes, but it is less valid to use estimates of risk from older studies, as the treatment of diabetes has changed over time.

Drivers in Utah were required to declare any medical conditions that would impair their driving on licensure, which made it possible to conduct a large scale study comparing the crash risks of groups with different medical conditions. There were 10,069 drivers registered with diabetes or other metabolic conditions. Drivers with diabetes were 1.3 times more at risk of being involved in a crash and 1.46 times more likely to be involved in a crash where they were at fault. (Diller et al 1999)

A large European project called 'Improved Motorists, Methods of Roadside Testing and Assessment for Licensing' (IMMORTAL) looked at the risk from a range of different health conditions by systematically reviewing the available literature. The review found that drivers with diabetes were 1.56 times more likely to be involved in an accident. This was unlikely to be due to chance. (Klemenjak et al 2005)

One case control study was conducted with participants in Norway who had been involved in a crash, 4,448 self reported questionnaires were completed, although this represented a low response rate of 30%, and there may have been a systematic difference between respondents and non-respondents. The characteristics of drivers who had been at fault for a crash were compared with drivers who had not. Drivers with diabetes who were not on medication were three times more at risk of being involved in a collision, after a calculation had been performed to remove the differences in driver age and distance travelled between the groups. It should be noted that there were only 24 drivers with diabetes and not on medication in the total sample of 4,448. (Sagberg 2006)

A multinational study recruited participants from seven US and four European diabetes speciality clinics. Participants voluntarily completed a one page questionnaire, and spouses also completed questionnaires to act as a comparison. No-one who was invited to complete a questionnaire declined to do so, and in total 341 people with type 1 diabetes, 332 people with type 2 and 363 spouses were recruited to the study. 19% of drivers with type 1 diabetes, 12% with type 2, and 8% of spouses reported at least one crash in the past two years. This result was unlikely to be due to chance. There was no difference between drivers with type 2 diabetes who were or were not using insulin. (Cox et al, 2007).

A study of drivers over the age of 65 in Quebec used data on all drivers licensed in that area who were involved in a collision between 1988 and 2000, cross-checked with information on the relevant health insurance and motor insurance databases. There were 111,699 drivers who had been involved in a collision of which 16,102 had diabetes. The risk of drivers with diabetes being involved in a collision was 7% higher than the control group, and although a slight increase in risk, the large numbers involved in the study meant that this was unlikely to be due to chance. The same increase in risk was also found when looking at severe collisions with material damages of over 500 Canadian dollars. The study did not differentiate between type 1 and type 2 diabetes, or look at the effects of different treatments. (Leproust et al 2007)

Another Canadian study looked at the relationship between diabetes and crash risk. The laws in many countries require that drivers control their blood glucose levels, on the basis that this should lower the risk of a crash. This study measured the effects of this control on crash risk by measuring glycosylated haemoglobin in diabetic drivers who were and were not involved in a crash. The study recruited diabetic drivers involved in a crash in Ontario from the start of 2005 to the start of 2007.

Overall, 57 patients were identified who were involved in a crash and 738 who were not. The level of glycosylated haemoglobin was lower in the drivers who crashed than those who had not, and was equivalent to a 26% increase in crash risk for every 1% reduction in glycosylated haemoglobin. The authors argue that this means that the level of glycosylated haemoglobin is neither necessary nor sufficient for determining fitness to drive. After taking into account the differences between glucose monitoring, complication and treatments between the two groups, as these may also influence crash risk, the relationship remained. (Redelmier, Kenshole and Ray, 2009)

All Norwegians aged 18 to 69 years old were included in a prospective cohort study from April 2004 to September 2006. Crash data was taken from the Road Accident Registry database, and new prescriptions of insulin were taken from a national prescription medication database. The crash risk of people who were prescribed insulin to lower blood glucose was compared with people who were not. A central population registry was also used to identify deaths and emigrations, which allowed an estimation of crashes per person time for both groups. There were 20,494 recorded traffic accidents during the period. Overall, drivers prescribed insulin to manage diabetes were 1.4 times more likely to be involved in a crash, and this was unlikely to be due to chance. (Skurtveit et al, 2009)

The authors also looked at crash risk between different age groups and genders; both men and women aged 18-34 and prescribed insulin were 1.5 times more likely to be involved in a crash and although there was a similar trend in all age groups, this was only unlikely to be due to chance in this age group. (Skurtveit et al, 2009)

Hypoglycaemia, which can cause cognitive impairment, behavioural changes, reduced consciousness, seizure and coma, increases accident risk, but most of the evidence linking hypoglycaemia to increased risk is based on insulin-treated diabetes. Hypoglycaemia risk in people receiving oral anti-diabetes agents may be underestimated. An analysis of people with type 2 diabetes, who were not treated with insulin, found that hypoglycaemia was associated with significantly increased risk of being involved in any accident, accidental falls and motor vehicle accidents. People under 65 years old with hypoglycaemia were significantly associated with an increase in the risk of motor vehicle accidents. (Signorovitch at al, 2012)

A recent systematic review searched for evidence on diabetes and fitness to drive, with a focus on studies that included drivers over 65 years. Several databases were searched for evidence dating from 1965, and internet searches were used to identify any literature that might not have been catalogued in databases. Twenty two relevant original studies were identified, after publications that did not meet the inclusion criteria were filtered out. (Kagan, Hashemi, Korner-Bitensky 2010)

Sixteen studies found that there was an increase in risk amongst drivers of all ages with diabetes, although there was a range of estimates from 1.04 to 3.24 more likely to be involved in an accident. The finding was unlikely to be due to chance in nine of the studies. (Kagan, Hashemi, Korner-Bitensky 2010)

Nine of the twenty-two studies looked at the risk of accident involvement amongst older drivers with diabetes, and seven of these found a higher risk of accident involvement. The range was from 1.06 to 2.88 times more likely to be involved in an accident, although this was potentially due to chance in seven of the studies. (Kagan, Hashemi, Korner-Bitensky 2010)

The systematic review also assessed the effect of diabetes type on accident risk. One study assessed type 1 and type 2 separately, and three studies just looked at type 1. Three of the studies found that type 1 increased crash risk irrespective of age, and this was unlikely to be due to chance in two of the three. (Kagan, Hashemi, Korner-Bitensky 2010)

The studies reviewed in this paper show that there is consistent evidence that the effects of diabetes can impair driving ability and increase crash risk and the risk is even higher for diabetic drivers who are not taking medication for the disease. Many countries, therefore, legally require drivers to be able to manage their diabetes in order to maintain their driving licence.

Hepatic encephalopathy was found to impair driving ability correlating with minimal hepatic encephalopathy (MHE) grade, with impaired vehicle lateral control in spite of reduced driving speed. Patients with MHE show psychomotor slowing, longer reaction times, impaired bimanual and visuo-spatial coordination and concentrated attention and slowed speed of anticipation and increased blood ammonia (Felipo, *et al*., 2013).

Although the risk of subsequent seizure after eclampsia affects patients' fitness to drive, research found that only 58% of healthcare professionals had considered discussing the issue of driving after an eclamptic seizure. For those who had considered the issue, advice ranged from no restriction - 4.6%, no driving for 1–2 weeks - 12.8%, no driving for 3 months - 18.4% or no driving for 6 months - 5.5% (Barrett, *et al*., 2013).

Epilepsy

Epilepsy is a notifiable condition for both Group 1 and Group 2 licence holders in the UK. Epilepsy is a chronic neurological condition defined by two or more unprovoked seizures. (WHO, 2001)

The prevalence of epilepsy in Western European countries is around 1% of the total population. (Charlton et al, 2010)

Studies on epilepsy and road crash risk are difficult to compare due to methodological differences. The majority of studies though report that drivers with epilepsy are twice as likely to be involved in a crash compared to the general driving population. The risk of crash reduces as the period between seizures increases. (Carter 2006, Charlton et al 2010)

In a review of research evidence, epilepsy was rated as having a considerably high overall crash risk. (Charlton et al, 2010)

Epilepsy was one of the eight medical conditions regarded as "high-risk" for crash involvement identified in a review of evidence from 2003-2009. (Charlton et al, 2010)
The research studies do not make it clear whether the drivers with epilepsy were treatment compliant at the time of survey.

Analysing the relationship between doctors and the Driving Licensing Authority (DLA), one study underscored the need to have a good relationship between doctors and the DLA, because it is ultimately the DLA which does have access to all reports and hence must take responsibility to make the final decision as to the outcome of each individual case. Doctors who are responsible to give such advice must be in control of all the facts, something that is not always possible (Beran and Patel, 2016).

Sleep Disorders

Group 1 and group 2 licence holders, must notify the DVLA if a driver suffers from excessive sleepiness or sleep apnoea.

Obstructive sleep apnoea syndrome (OSAS) manifests in a lack of non-restorative and disrupted night time sleep, resulting in excessive daytime fatigue and sleepiness (Smolensky et al, 2011).

A case-control study cited as the reference study on sleep apnoea matched patients by age and sex and found that apneics had a six- fold increase in road crash risk compared with controls (Teran-Santos et al 1999, cited in Smolensky et al, 2011).

A meta-analysis of 40 studies of OSAS and driving crash risk revealed that for non-commercial drivers, 18 out of the 19 studies which included a control group showed a statistically significant crash risk for apneics: up to two-three times higher than controls (Ellen et al 2006, cited in Smolensky et al, 2011).

In a review of research evidence relating to western countries, sleep apnoea was listed as one of only eight conditions found to have a significantly elevated risk of crash involvement. Compared to controls, drivers with sleep apnoea were classified by the researchers as having a, "considerably high", overall crash risk. (Charlton et al, 2010)

Sleep apnoea was one of the eight medical conditions regarded as "high-risk" for crash involvement identified in a review of evidence from 2003-2009 (Charlton et al, 2010)

Post-treatment with Continuous Positive Airway Pressure (CPAP), however, is an effective treatment. The overall crash risk of apneic drivers was lower than that of controls without OSAS. (Charlton et al, 2010)

A study on the clinicians' opinions and actions in relation with patients with OSAS and fitness to drive revealed that 74% of the clinicians had never reported patients to the DVLA, 23% had reported one to four times and 3% had reported more than five times. Moreover, only 1% of clinicians always and 4% frequently use objective tests to help in their assessment. Professional drivers are more likely to undergo objective tests than non-professional drivers (Dwarakanath, *et al*., 2014).

Insommnia is characterised by a lack of non-restorative sleep resulting in lethargy, reduced daytime alertness, compromised cognitive function and altered behavioural or emotional state. (Smolensky et al, 2011)

A prospective study interviewed 369 workers with insomnia. The insomnia sufferers were paired with control participants who were good sleepers and matched for age, sex and occupational status. Through interviews with a medical doctor and self-complete questionnaires, the insomniacs were found to have a higher road accident rate and a three-fold greater risk for two or three serious road crashes. (Ellen et al 2006, cited in Smolensky et al, 2011)

In the Norwegian study of crash-involved drivers randomly selected from an insurance company's database, sleep onset insomnia was associated with a significantly increased risk of being at fault for a road crash. Sleep apnoea however, after controlling for age and annual driving distance, was not a significant indicator for being at fault in a road traffic crash. This study though had the methodological weakness of underreporting whereby the true relative risks of certain medical conditions being associated with 'at fault' road crashes may be higher than those estimated. (Sagberg, 2006)

Other medical conditions can affect the quality or quantity of a driver's sleep which in turn can affect driving performance and crash risk: "The evidence is compelling that severe daytime sleepiness, tiredness, and/or fatigue - whether the result of a primary sleep disorder or an acute or chronic medical condition – can compromise the cognitive performance of commercial and non-commercial drivers and contribute to traffic crashes." (Smolensky et al, 2011)

Narcolepsy is a rare neurological condition which can cause excessive daytime sleepiness, sudden attacks of sleep, and cataplexy (temporary loss of muscle function). (Smolensky et al 2011, Charlton et al 2010)

Although multiple driving simulator studies have found substantial inconsistency in the cognitive performance of narcoleptics, there is insufficient robust evidence to form conclusions about crash risk. (Smolensky et al, 2011)

A review of the evidence on medical conditions and driver crash involvement found that the evidence was "highly equivocal" or there was "no evidence" in order to give narcolepsy a risk rating for overall crash risk. (Charlton et al, 2010)

For further evidence on tiredness and driving refer to the **Fatigue** review.

Cardiovascular Disease

DVLA notification of cardiovascular problems is only obligatory for Group 2 drivers. Group 1 drivers are advised that they should restart driving only when their doctor tells them they are safe to do so.

Cardiovascular disorders affect the supply of oxygen to vital organs. Cerebrovascular disorders affect the supply of oxygen to the brain.

In 2000 the prevalence of cardiovascular disease in Western Europe was estimated by the WHO at around 0.8% of the adult population. As age increases so too does the prevalence of heart disease. (Charlton et al, 2010)

The prevalence of cerebrovascular disease (stroke) in Western Europe was estimated to be at around 1% of the total population. Approximately 75% of strokes occur in adults aged 65 and over. (Charlton et al, 2010)

There is inconsistent research evidence regarding the association between cardiovascular disease and driver crash risk. (Charlton et al, 2010)

A French study where cases were drivers at least partially responsible for a road traffic crash, and controls were drivers stating that they were not responsible, found that arterial hypertension was the *only* disease significantly associated with responsibility for a road traffic crash. For the conditions of glaucoma, diabetes, epilepsy and sleep apnoea, the numbers of affected drivers in this study were too small (10 or less) to be able to evaluate the relative risk. (Hours et al, 2008) Only 5.8% of the drivers reporting medical conditions in this study suffered from arterial hypertension.

The Norwegian insurance database study found that the only cardiovascular conditions significantly associated with increased risk of being at fault in a road traffic crash were stroke and heart attack. The relative risk associated with stroke was even greater when not adjusted for age and driving distance. Hypertension (high blood pressure) was not associated with increased risk. (Sagberg, 2006)

In a review of evidence between 2003 and 2009 the conclusion was that stroke "generally" lead to impairments in driving performance but that the evidence was too limited to assess crash risk. (Charlton et al, 2010)

Research looking into the agreement between medical and practical recommendations of fitness to drive, for after stroke patients, found a 73% agreement between the two groups of recommendations. Physicians disagreed on 92% of patients classified as unfavourable and 80% of those classified as reserved by the on-road assessor. Previous visits to the driving centre and number of comorbidities predicted medical fitness-to-drive recommendations. Age, previous visits to the centre, binocular acuity and driving experience constituted the best model to predict practical fitness-to-drive recommendations (Ranchet, *et al*., 2016).

One study analysing the cardiovascular risk factors of taxi drivers, found that subjects who worked as a taxi driver for more than 10 years and had mental exertion from cab driving >5 out of 10 were more likely to have a cardiovascular high-risk profile. As a conclusion, researchers suggested that system-level or worksite interventions should include offering healthy food at taxi dispatching locations, creating a work culture of frequent walking breaks, and that interventions should be focusing on smoking, physical activity, and weight management (Elshatarat and Burgel, 2016).

There is no consistent body of evidence in the studies included in this review linking cardiovascular disease as a group of disorders, or any of its individual forms, to increased crash risk (Carter, 2006). Although the evidence is inconclusive regarding cardiovascular disease and driver crash risk, heart disease has been shown to be the most common cause of sudden death at the wheel. (Carter 2006, Charlton et al 2010)

Hearing Impairments

Group 1 licence holders (car and motorcycle) deaf drivers or riders need not notify the DVLA. Group 2 licence holders (bus, coach or lorry) deaf drivers **must** notify the DVLA. Professional drivers need to be able to communicate with police officers, for example, in the event of an emergency.

Hearing impairments can potentially impact on road safety by affecting drivers' ability to detect and therefore respond to: sirens, horns, engine and tyre problems, road sounds, and other traffic and road users. (Hersh et al, 2010)

A Norwegian case-control study found that drivers reporting severe hearing impairments were not significantly associated with risk of being at fault for a road traffic crash after controlling for age and annual driving distance (Sagberg, 2006).

The Norwegian study (Sagberg, 2006) was based on a random sample of 15,000 car owners but only 4,448 car owners returned the questionnaire. Although the questionnaires were anonymous, the sample was drawn from an insurance company's database of policy holders reporting a recent crash. As the invitation to take part in the study came from the insurance company it is likely the low response rate was due at least in part to drivers fearing the information provided may adversely affect their insurance claim. Thus there may have been an underreporting of medical conditions and whether or not the drivers were on medication.

A French case-control study of 733 drivers who attended hospital after a road traffic crash similarly found no significant risk associated with hearing problems. In this study drivers were self-classified as either responsible for the collision or not responsible. Different diseases were analysed for association with crash responsibility. Drivers with self-reported hearing problems were not associated with a higher risk of being responsible for a crash. (Hours et al, 2008)

Looking at the associations between visual, hearing, and dual sensory impairments and history of motor vehicle collision (MVC) involvement of older drivers, research found that older drivers with dual sensory impairment are at greater MVC risk than those with a visual acuity or hearing deficit alone. Drivers with visual acuity loss alone or hearing loss alone did not have MVC rates that were significantly different from those of the no impairment group after adjustment for multiple variables. Research suggests that a combined screening approach of screening for hearing and visual impairment may be a useful tool to identify older drivers at risk of MVC involvement (Green, McGwin and Owsley, 2013).

A UK guide for health professionals summarised that there was a dearth of research studies on hearing and crash risk. (Carter and Read, 2006)

Musculoskeletal Impairments

The DVLA must be notified if a driver of any licence type has had a limb amputation, spinal injury or has been diagnosed with multiple sclerosis. Arthritis sufferers need only notify the DVLA if they use special adaptive vehicle controls.

Diseases and injuries of the musculoskeletal system have some impact on physical ability. The impairments can affect motor skills and co-ordination. Conditions include arthritis, multiple sclerosis, spinal injuries and limb amputations.

The prevalence of osteoarthritis in Western European countries is around 4.1% of the total population, mostly affecting older adults. (Charlton et al, 2010)

The prevalence of rheumatoid arthritis in Western European countries is around 0.7% of the total population. (Charlton et al, 2010)

In the Norwegian insurance database study no musculoskeletal conditions were associated with significant increases in risk of crash responsibility - after age and annual driving distance were controlled for. (Sagberg, 2006)

A review of evidence on medical conditions and crash involvement summarised that there was only a slightly increased risk of road traffic crash for drivers with musculoskeletal disorders. (Charlton et al, 2010)

The risk of drivers of specially adapted cars having a road traffic crash is equivalent to that of drivers in the general population. (Charlton et al, 2010)

Several studies of older drivers have shown an increased crash risk for those with restricted neck and limb movement. (Carter, 2006)

REFERENCES

Title:	**Fitness to Drive: A Guide for Health Professionals**
Author:	Tim Carter
Published:	Department for Transport, 2006
Link:	http://occmed.oxfordjournals.org/content/57/8/615.1.full
Objectives:	To provide valid advice about health-related impairments to health professionals who have to advise patients on their fitness to drive.
Methodology:	Review of evidence

Key Findings:

- Provides guidance on:
  - the capabilities required for safe driving, the effects of different forms of impairment, how risks are reduced, responsibilities for action (in particular the role of health professionals) and ways in which the personal mobility of a driver can be maintained, without compromising road safety.
  - Sensory inputs needed for safe driving, especially vision. The capabilities of mental function and of the nervous system that are needed for driving and the impairing effects of medication, alcohol and non-therapeutic drugs on driving.
  - The consequences for the control of a vehicle of limitations to the driver's movement from injury, surgery and musculoskeletal disease.
  - The main forms of sudden incapacitation that can threaten a driver's ability to remain in control of a vehicle.
- Limited number of studies looking at hearing impairments and driver crash risk
- No consistent body of evidence linking cardiovascular disease to increased crash risk
- Cognitive impairments of multiple sclerosis affect driver performance and crash risk significantly more than physical impairments
- Most studies show at least some increased crash risk in drivers with epilepsy
- Health-related impairments are only responsible for a fraction of total crash risk.

Format: book	**Cost:** priced
Themes:	Fitness to drive, mental health

Title:	**Diseases, consumption of medicines and responsibility for a road crash: A case-control study**
Author:	Hours, M, Fort E, Charnay P, Bernard M, Martin JL, Boisson D, Sancho PO, Laumon B.
Published:	Accident Analysis and Prevention Vol. 40 (5), 2008
Link:	http://www.ncbi.nlm.nih.gov/pubmed/18760109
Objectives:	To evaluate the role of medical conditions in responsibility for being injured as a driver in a road traffic crash.
Methodology:	Case-control study. Sample of 733 drivers who attended hospital after a motor vehicle crash. Interview data.
Key Findings: • No risk of responsibility associated with having cardiovascular diseases nor nervous system diseases • Medical conditions are less of a risk factor in road traffic crashes than behavioural factors • The only disease found to be associated with responsibility was hypertension	
Format: PDF	**Cost:** Priced

Title:	**Contributory Factors to Reported Road Accidents 2011**
Author:	Department for Transport
Published:	Department for Transport, 2012
Link:	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/9277/rrcgb2011-04.pdf
Objectives:	To provide insight into why and how road accidents occur.
Methodology:	Analysis of contributory factors assigned to reported road accidents by police officers attending the accident scenes.

Key Findings:

- In 2011, "Illness or disability, mental or physical" was reported as a contributory factor in:

  109 (7%) of reported fatal road accidents
  458 (2%) of reported serious road accidents
  1,460 (1%) of reported slight road accidents
  2,027 (2%) of reported all reported road accidents

- "Illness or disability, mental or physical" was reported as a contributory factor in:

  117 (7%) of reported fatal road casualties
  561 (3%) of reported serious road casualties
  2,450 (2%) of reported slight road casualties
  3,128 (2%) of reported all reported road casualties

- Contributory factors are largely subjective, reflecting the opinion of the reporting police officer, and are not necessarily the result of extensive investigation. Some factors are less likely to be recorded. Subsequent enquiries could lead to the reporting officer changing his/her opinion.
- The contributory factors are different from the remainder of the STATS19 data which is based on the reporting of factual information. While this information is valuable in helping to identify ways of improving safety, care should be taken in its interpretation.

Format: Pdf	Cost: Free
Themes:	Eyesight and Driving, Fitness to Drive

Title:	**Reported Road Casualties Great Britain 2013**
Author:	Department for Transport
Published:	Department for Transport, 2014
Link:	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/359311/rrcgb-2013.pdf
Objectives:	To provide insight into why and how road accidents occur.
Methodology:	Analysis of contributory factors assigned to reported road accidents by police officers attending the accident scenes.

Key Findings:

- In 2013, "Illness or disability, mental or physical" was reported as a contributory factor in:

  91 (6%) of reported fatal road accidents
  481 (3%) of reported serious road accidents
  1,622 (2%) of reported slight road accidents
  2,194 (2%) of reported all reported road accidents

- "Illness or disability, mental or physical" was reported as a contributory factor in:

  95 (6%) of reported fatal road casualties
  594 (3%) of reported serious road casualties
  2,555 (2%) of reported slight road casualties
  3,244 (2%) of reported all reported road casualties

- Contributory factors are largely subjective, reflecting the opinion of the reporting police officer, and are not necessarily the result of extensive investigation. Some factors are less likely to be recorded. Subsequent enquiries could lead to the reporting officer changing his/her opinion.
- The contributory factors are different from the remainder of the STATS19 data which is based on the reporting of factual information. While this information is valuable in helping to identify ways of improving safety, care should be taken in its interpretation.

Format: Pdf	Cost: Free
Themes:	Eyesight and Driving, Fitness to Drive

Title:	**Reported Road Casualties Great Britain 2014**
Author:	Department for Transport
Published:	Department for Transport, 2015
Link:	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/463797/rrcgb-2014.pdf
Objectives:	To provide insight into why and how road accidents occur.
Methodology:	Analysis of contributory factors assigned to reported road accidents by police officers attending the accident scenes.

Key Findings:

- In 2014, "Illness or disability, mental or physical" was reported as a contributory factor in:

  102 (7%) of reported fatal road accidents
  583 (3%) of reported serious road accidents
  1,734 (2%) of reported slight road accidents
  2,419 (2%) of reported all reported road accidents

- "Illness or disability, mental or physical" was reported as a contributory factor in:

  112 (7%) of reported fatal road casualties
  710 (4%) of reported serious road casualties
  2,877 (2%) of reported slight road casualties
  3,699 (2%) of reported all reported road casualties

- Contributory factors are largely subjective, reflecting the opinion of the reporting police officer, and are not necessarily the result of extensive investigation. Some factors are less likely to be recorded. Subsequent enquiries could lead to the reporting officer changing his/her opinion.
- The contributory factors are different from the remainder of the STATS19 data which is based on the reporting of factual information. While this information is valuable in helping to identify ways of improving safety, care should be taken in its interpretation.

Format: Pdf	Cost: Free
Themes:	Eyesight and Driving, Fitness to Drive

Title:	**Suicide and Natural Deaths in Road Traffic: Review**
Author:	Virginia Routley, Carolyn Staines, Chris Brennan, Narelle Haworth, Joan Ozanne-Smith
Published:	Monash University Accident Research Centre, Report Number 216, 2003
Link:	http://www.monash.edu.au/miri/research/reports/muarc216.pdf
Objectives:	Assess the available knowledge of suicides and natural death as a cause of traffic injury.
Methodology:	Non-systematic review of the available literature
Key Findings: • 13 studies were identified that estimated the proportion of traffic fatalities that were suicides. • The range of estimates was from 14.3% to 0%. Most studies found results between 1% and 3%. • It is difficult to accurately determine the proportion of traffic crashes due to suicide.	
Format: pdf	**Cost:** free
Themes:	Fitness to drive, mental health, depression, suicide

Title:	**Evaluating the Crash and Citation Rates of Utah Drivers Licensed with Medical Conditions, 1992-1996**
Author:	Vernon DD, Diller EM, Cook LJ, Reading JC, Suruda AJ, Dean JM.
Published:	Accident Analysis and Prevention, 34(2), 2002
Link:	http://www.ncbi.nlm.nih.gov/pubmed/11829294
Objectives:	To compare the rates of crashes amongst drivers with different medical conditions
Methodology:	A case control study
Key Findings: • Drivers with reported medical conditions had a modestly increased crash risk between 9% and 74% higher than drivers without. • Drivers with psychiatric conditions were 57% more likely to be involved in a collision than drivers without.	
Format: pdf	**Cost:** Priced
Themes:	Mental health, fitness to drive

Title:	**Psychiatric Risk Factors for Motor Vehicle Fatalities in Young Men**
Author:	Dumais, Lesage, Boyer, Lalovic, Chawky, Menard-Buteau, Kim and Turecki
Published:	Can J Psychiatry;50(13), 2005
Link:	http://www.ncbi.nlm.nih.gov/pubmed/16483118
Objectives:	To compare mental health in a group of fatally injured young male drivers with a control group.
Methodology:	A case-control study.
Key Findings: • Substance misuse is a risk factor in young male driver deaths, over the age of 26.	
Format: pdf	**Cost: priced**
Themes:	Fitness to drive, mental health, substance misuse

Title:	**Evaluating Drivers Licensed with Medical Conditions in Utah, 1992 -1996**
Author:	E. Diller, L. Cook, D. Leonard, J. Reading, J. M. Dean and D. Vernon
Published:	NHTSA DOT HS 809 023, June 1999
Link:	http://ntl.bts.gov/lib/25000/25900/25974/DOT-HS-809-023.pdf
Objectives:	To compare crash and at fault crash rates between drivers with and without registered medical conditions.
Methodology:	Cohort including all drivers licensed in Utah.
Key Findings: • In 1979, a program to screen drivers for medical conditions was introduced in Utah. • Measuring crashes per licence days, drivers with learning, memory, or communication impairments and/or cognitive defects were 2.19 times more likely to be involved in a crash and 3.32 times more likely to be legally responsible for causing a crash.	
Format: pdf	**Cost:** free
Themes:	Fitness to drive, mental health

Title:	**Driving Cessation and Self-reported Car Crashes in Older Drivers: the Impact of Cognitive Impairment and Dementia in a Population-based Study**
Author:	Lafont, Laumon, Helmer, Dartigues and Fabrigoule.
Published:	J Geriatr Psychiatry Neurol; 21(3), 2008
Link:	http://www.ncbi.nlm.nih.gov/pubmed/18503033
Objectives:	To improve the knowledge on driving cessation, dementia and crash risk.
Methodology:	A cross sectional study
Key Findings: • Dementia was associated with driving cessation. • Older drivers were more at risk of being injured in an accident. • Dementia was not associated with accident involvement.	
Format: pdf	**Cost:** priced
Themes:	Mental health, fitness to drive, dementia

Title:	**Risk of Driving and Alzheimer's Disease (An Evidence Based Review)**
Author:	Richard M. Dubinsky, Anthony C. Stein, and Kelly Lyons
Published:	Neurology 2000;54:2205-2211
Link:	http://www.neurology.org/content/54/12/2205.full.html
Objectives:	To review the risk of driving with dementia.
Methodology:	Systematic review
Key Findings: • 14 studies were identified which answered the research question. The assessment of dementia in different studies were mapped against a scale called the Clinical Dementia Rating • A Clinical Dementia Rating of 1 or higher led to a significantly higher risk of being involved in an accident • A Clinical Dementia Rating of 0.5 to 1 was associated with a higher risk of being involved in a crash. The authors recommended that the patents with this severity of dementia should be kept under review given the high likelihood of the condition worsening.	
Format: pdf	**Cost:** priced
Themes:	Fitness to drive, mental health, dementia

Title:	**Examination of Naturalistic Driving Practices in Drivers with Parkinson's Disease Compared to Age and Gender-matched Controls**
Author:	Alexander M. Crizzle and Anita M. Myers
Published:	Accident Analysis and Prevention, 50, 2013
Link:	http://www.sciencedirect.com/science/article/pii/S0001457512002497
Objectives:	To examine naturalistic driving practices (exposure and patterns) in older drivers with Parkinsons Disease (PD) compared to a matched control group to determine if the PD group showed more restricted driving practices, and to examine the influence of self-regulatory practices.
Methodology:	Electronic devices were installed in the vehicles of 27 drivers with PD (aged 57 to 82 years) and 20 matched controls for two weeks.

Key Findings:

- Previous research has shown that safe driving requires a combination of motor, visual spatial and executive skills (information processing, attention, quick decision-making) that can be compromised in drivers with progressive neurological disorders, such as Parkinson's disease (PD).
- For example, compared to drivers without neurological disorders, those with PD have more difficulty with operational and tactical manoeuvres such as maintaining lane position, turning, steering and speed control.
- Although the symptoms associated with PD can affect driving ability in the early stages of the disease, some studies have found that the majority of subjects with PD were still competent drivers, possibly because they had modified their driving practices.
- This study found that a greater proportion of the PD group preferred to drive with a passenger (48% versus 15%), while proportionately more of the controls preferred to drive alone (40% versus 11%).
- Compared to 10 years ago, 67% of the PD group and 45% of the controls said they now drove less; about a third of both groups drove about the same amount, while 4% of the PD drivers and 20% of the controls said they drove more.
- On average, the PD group drove significantly fewer days, trips, stops, km and for shorter durations than the control group. When adjusted for number of days driven, the PD group still made significantly fewer trips but slightly more stops per trip.
- The findings provide preliminary evidence that drivers with PD appear to restrict their driving practices to a greater extent than drivers without neurological disorders.

Format: pdf	**Cost:** priced
Themes:	**Fitness to drive, mental health, dementia**

Title:	**Factors Influencing the Behaviour of People Who Drive at Work**
Author:	Catriona O'Dolan, Steve Stradling
Published:	Behavioural Research in Road Safety: Sixteenth Seminar. London: Department for Transport, 2006
Link:	http://researchrepository.napier.ac.uk/2587/1/DolanStradlingFactors_influencing_the_behaviour_of_people_who_drive_at_work.pdf
Objectives:	To compare the differences between drivers beliefs about driving for work and in their own time.
Methodology:	A cross sectional survey
Key Findings: • 35% found driving for work stressful whilst only 15% reported driving outside work stressful. • 61% agreed that they were often under time pressures when driving for work compared to 25 % who felt these pressures outside work.	
Format: pdf	**Cost:** free
Themes:	Mental health, fitness to drive, stress

Title:	**The Company Car Driver, Occupational Stress as a Predictor of Motor Vehicle Accident Involvement**
Author:	Cartwright, Cooper and Barron
Published:	Human Relations February 1996 vol. 49 no. 2 195-208
Link:	http://hum.sagepub.com/content/49/2/195.short
Objectives:	To investigate the effects of occupational stress on traffic accidents.
Methodology:	A case-control study
Key Findings: • Occupational stress was associated with an increased risk of being involved in an accident. • Poor time management, lack of social support, poor managerial responsibility, job dissatisfaction and stress about home/work balance all increase risk.	
Format: pdf	**Cost:** priced
Themes:	Fitness to drive, mental health, stress

Title:	**Can Organisational Safety Climate and Occupational Stress Predict Work-Related Driver Fatigue?**
Author:	Strahan, Watson and Lennon
Published:	Transportation Research Part F: Traffic Psychology and Behaviour 11(6):pp. 418-426.
Link:	http://eprints.qut.edu.au/15201/1/15201.pdf
Objectives:	To understand the relationship between occupational stress, safety culture and fatigue related near miss accidents.
Methodology:	Self reported survey
Key Findings: • Occupational stress and safety culture were associated with the increased likelihood of fatigue related near misses.	
Format: pdf	**Cost:** free
Themes:	Mental health, fitness to drive, stress, safety culture

Title:	**The Warwick-Edinburgh Mental Well-being Scale (WEMWBS): development and UK validation**
Author:	Tennant, Hiller, Fishwick, Platt, Joseph, Weich, Parkinson, Secker and Stewart-Brown
Published:	Health and Quality of Life Outcomes 2007*, 5:*63
Link:	http://www.hqlo.com/content/5/1/63
Objectives:	To validate the Warwick-Edinburgh Mental Well-being Scale (WEMWBS) for use in adults
Methodology:	A validation study
Key Findings: • The Warwick-Edinburgh Mental Well-being Scale (WEMWBS) is a reliable scale. • The Warwick-Edinburgh Mental Well-being Scale (WEMWBS) is validated for use on adults.	
Format: Html	**Cost:** free
Themes:	Fitness to drive, mental health, wellbeing

Title:	**IMMORTAL Deliverable A3.2 FINAL PROGRAMME REPORT Public**
Author:	W. Klemenjak, E. Braun, J. Alvarez, I.M. Bernhoft, L. Fjerdingen
Published:	IMMORTAL D-A3.2, 2005
Link:	http://ec.europa.eu/transport/roadsafety_library/publications/final_programme_report.pdf
Objectives:	To identify the risk of different medical conditions on driving risk.
Methodology:	Systematic review
Key Findings: • Drivers with diabetes were 1.56 times more likely to be involved in an accident than drivers without.	
Format: pdf	**Cost:** Free

Title:	**Driver Health and Crash Involvement: A Case-Control Study**
Author:	Sagberg, F.
Published:	Accident Analysis and Prevention Vol. 38 (1), 2006
Link:	http://www.sciencedirect.com/science/article/pii/S0001457505001156
Objectives:	To investigate the relative crash involvement risk associated with diagnosed medical conditions.
Methodology:	Postal questionnaire of a random sample of 4448 crash-involved drivers in Norway

Key Findings:

- Only 10 out of 54 medical conditions were significantly associated with increased risk of crash
- Hypertension not associated with elevated crash risk
- The only cardiovascular conditions that had a significant relative risk were stroke and heart attack
- The greatest relative risk of crash involvement of all the conditions studied was for stroke
- Insomnia associated with increased risk but not sleep apnoea
- No musculoskeletal conditions associated with increased risk
- Severe hearing impairments were not associated with increased risk
- Possibility of under-reporting of some diseases and medication status
- Drivers with diabetes who were not on medication were three times more at risk of being involved in a collision

Format: PDF	**Cost:** Priced

Title:	**Diabetes and Driving Mishaps: Frequency and correlations from a multinational survey**
Author:	Cox, Penberthy, Zrebiec, Weinger, Aikens, Frier, Stetson, DeGroot, Trief, Schaechinger, Hermanns, Gonder-Frederick, and Clarke
Published:	Diabetes Care August 2003 vol. 26 no. 8 2329-2334
Link:	http://care.diabetesjournals.org/content/26/8/2329.abstract
Objectives:	To investigate whether diabetes is associated with injury and driving mishaps.
Methodology:	Self reported questionnaire

Key Findings:

- 19% of drivers with type 1 diabetes, 12% with type 2, and 8% of spouses reported at least one crash in the past 2 years.
- This result was unlikely due to chance. There was no difference between drivers with type 2 diabetes who were or were not using insulin.

Format: pdf	**Cost:** Priced
Themes:	Fitness to Drive

Title:	**Association between road vehicle collisions and recent medical contact in older drivers: a case-crossover study**
Author:	Leproust, Lagarde, Suissa, Salmi
Published:	Injury Prevention, 2007 December; 13(6): 382–387.
Link:	http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2598292/
Objectives:	To establish the relationship between collisions and medical conditions in drivers over the age of 65.
Methodology:	Case-crossover
Key Findings: • There was a weak but statistically significant increased risk of collisions for drivers diagnosed with diabetes of 7% • There was also a weak but statistically significant 7% increase in the risk of collisions where the costs were over 500 Canadian dollars for divers diagnosed with diabetes	
Format: pdf	**Cost:** Free
Themes:	Fitness to Drive

Title:	**Motor Vehicle Crashes in Diabetic Patients with Tight Glycemic Control: A Population-based Case Control Analysis**
Author:	Redelmeier, Kenshole, and Ray
Published:	PLoS Med 6(12), 2009
Link:	http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.1000192
Objectives:	To identify the association between glycosylated haemoglobin and crash risk.
Methodology:	Case control study
Key Findings: • The mean glycosylated haemoglobin was lower in drivers who were involved in a crash. • This was equal to a 26% increase in the relative risk for every 1% decrease in glycosylated haemoglobin.	
Format: Html	**Cost:** Free

Title:	**Road traffic accident risk in patients with diabetes mellitus receiving blood glucose-lowering drugs. Prospective follow-up study**
Author:	Skurtveit S, Strøm H, Skrivarhaug T, Mørland J, Bramness JG, Engeland A
Published:	Diabet Med. 2009 Apr;26(4):404-8
Link:	http://www.ncbi.nlm.nih.gov/pubmed/19388971
Objectives:	To evaluate the relationship between diabetes and crash risk at a national level.
Methodology:	Prospective cohort study
Key Findings: • Drivers who were prescribed insulin to manage diabetes were 1.4 times more likely to be involved in a crash, and this was unlikely to be due to chance. • Men and women aged 18-34 who were prescribed insulin were both 1.5 times more likely to be involved in a crash. • Drivers of different age groups who were prescribed insulin appeared to be at a higher risk of a crash, although this may have been due to chance.	
Format: pdf	**Cost: Priced**

Title:	**Hypoglycaemia and accident risk in people with type 2 diabetes mellitus treated with non-insulin antidiabetes drugs**
Author:	J. E. Signorovitch, D. Macaulay, M. Diener, Y. Yan, E. Q. Wu, J.-B. Gruenberger & B. M. Frier
Published:	Diabetes, Obesity and Metabolism, 2012
Link:	http://www.ncbi.nlm.nih.gov/pubmed/23121373
Objectives:	To assess the relationship between hypoglycaemia and risk of accidents resulting in hospital visits among people with type 2 diabetes receiving anti-diabetes drugs without insulin.
Methodology:	People with type 2 diabetes not treated with insulin were identified from a database covering more than 12 million employees, retirees, spouses and dependents from self-insured companies in the USA. People with a recorded diagnosis of type 2 diabetes who had filled at least two prescriptions for an anti-diabetes drug, but had no evidence of insulin use, were identified between 1 January 1998 and 31 March 2010. People with insulin use were excluded from the analysis. A random sub-sample of people without hypoglycaemia was chosen to achieve a 5:1 ratio to the sample with hypoglycaemia. 5,582 people had medical service claims related to hypoglycaemia and 128,966 without, of whom 27,910 were randomly sampled to serve as controls in a 1-5 ratio.
Key Findings: • Accidents resulting in hospital visits occurred in 5.5% and 2.8% of people with, and without, hypoglycaemia, respectively. • After adjusting for baseline characteristics, hypoglycaemia was associated with significantly increased hazards for any accident, accidental falls and motor vehicle accidents. • Hypoglycaemia was associated with greater hazards of driving-related accidents in people younger than 65 years and falls in people aged 65 or older. • Falls were the most frequent type of accident. • For every 10,000 patient-years of follow-up in people with medical claims for hypoglycaemia compared with those without, there was an expected 38 additional accidents of any type, 14 additional accidental falls and 6.6 additional motor vehicle accidents. • Younger people had an overall greater risk of motor vehicle accidents compared with older people. • Among the younger people, hypoglycaemia was significantly associated with a greater than130% increase in the risk of motor vehicle accidents. • Hypoglycaemia was not associated with motor vehicle accident risk among the older individuals, possibly because they adjusted their driving behaviour (self-regulation).	
Format: pdf	**Cost:** Priced

Title:	**Diabetes Fitness to Drive: A Systematic Review of the Evidence with a Focus on Older Drivers**
Author:	Kagan, Hashemi, Korner-Bitensky
Published:	Canadian Journal of Diabetes Volume 34, Issue 3 , Pages 233-242, 2010
Link:	http://www.sciencedirect.com/science/article/pii/S1499267110430129
Objectives:	To establish the relationship between diabetes and crash risk from previously published studies.
Methodology:	Systematic review
Key Findings: • Twenty two relevant original studies were identified by the review. • Sixteen studies found that accidents were 1.04 to 3.24 times more likely amongst drivers of all ages with diabetes. • Nine studies found that accidents were 1.06 to 2.88 times more likely amongst drivers over 65 years old with diabetes. • Three studies found that type 1 diabetes increased crash risk amongst drivers of all ages.	
Format: pdf	**Cost:** Priced

Title:	**Epilepsy Factsheet No. 999**
Author:	World Health Organisation
Published:	October 2012, accessed online 11/02/13
Link:	http://www.who.int/mediacentre/factsheets/fs999/en/index.html
Objectives:	Key facts media communication about epilepsy
Methodology:	N/A Fact Sheet
Key Findings: • Epilepsy is a chronic disorder of the brain affecting people of all ages. • Around 50 million people worldwide have epilepsy. • Epilepsy is characterised by recurrent seizures.	
Format: PDF	**Cost:** Free

Title:	**Influence of Chronic Illness on Crash Involvement of Motor Vehicle Drivers: 2nd Edition Report No. 30**
Author:	J Charlton, S Koppel, M Odell, A Devlin, J Langford, M O'Hare, C Kopinathan, D Andrea, G Smith, B Khodr, J Edquist, C Muir and M Scully
Published:	Monash University Accident Research Centre (2010)
Link:	http://www.monash.edu.au/miri/research/reports/muarc300.pdf
Objectives:	A review of evidence for the influence of chronic illness and impairments on crash involvement of motor vehicle drivers for the period May 2003 – mid 2009
Methodology:	Literature review
Key Findings: • Eight conditions were found to have an elevated risk of crash involvement: Alcohol abuse, dementia, epilepsy, multiple sclerosis, psychiatric disorders, schizophrenia, sleep apnoea and cataracts.	
Format: PDF	**Cost:** Free

Title:	**Sleep Disorders, Medical Conditions and Road Accident Risk**
Author:	Smolensky, M.H., Milia, L.D., Ohayon, M.M., and Philip, P.
Published:	Accident Analysis and Prevention Vol 43 (2011)
Link:	http://www.ncbi.nlm.nih.gov/pubmed/21130215
Objectives:	To review of the potential contribution of prevalent medical conditions to the risk for drowsy-driving road crashes.
Methodology:	Literature review
Key Findings: • Elevated risk of road crashes for drivers with sleep apnoea. • Insufficient robust research studies to accurately assess the level of risk posed by narcolepsy. • Multiple medical conditions can affect a person's sleep, not just primary sleep disorders. • Severe daytime sleepiness can compromise the cognitive performance of drivers.	
Format: PDF	**Cost:** Priced

Title:	**Investigating Road Safety Issues and Deaf People in the UK: An Empirical Study and Recommendations for Good Practice**
Author:	Hersh, M., Ohene-Djan, J., and Naqvi, S.
Published:	Journal of Prevention and Intervention in the Community, Vol. 38 (2010)
Link:	http://www.ncbi.nlm.nih.gov/pubmed/20945247
Objectives:	To fill the gap in knowledge of road safety issues for deaf and hard of hearing people.
Methodology:	Questionnaire survey
Key Findings: • Hearing plays an important role in driving and road safety. • There is little empirical data on the effects of deafness on driving performance.	
Format: PDF	**Cost:** Priced

Title:	**A European approach to categorizing medicines for fitness to drive: outcomes of the DRUID project**
Author:	S. Ravera, S. P. Monteiro, J. J. de Gier, T. van der Linden, T. Gómez-Talegón and F. J. Álvarez
Published:	British Journal of Clinical Pharmacology, December 2012
Link:	http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2125.2012.04279.x/full
Objectives:	The study describes standardized and harmonized criteria to categorize medications according to their potential to impair fitness to drive. The study proposes a European categorization system of medications that impair driving that covers all the most frequently prescribed medications.
Methodology:	The development of the DRUID categorization system was based on several criteria. The following steps were considered: (i) conditions of use of the medicine, (ii) pharmacodynamic and pharmacokinetic data, (iii) pharmacovigilance data, including prevalence of undesirable effects, (iv) experimental and epidemiological data, (v) additional data derived from the patient information leaflet, existing categorization systems and (vi) final categorization. DRUID proposed four tiered categories for medicines and driving.
Key Findings: • In total, 3054 medicines were reviewed and over 1541 medicines were categorized (the rest were no longer on the EU market). Nearly half of the 1541 medicines were categorized 0 (no or negligible influence on fitness to drive), about 26% were placed in category I (minor influence on fitness to drive) and 17% were categorized as II or III (moderate or severe influence on fitness to drive).	
Format: pdf	**Cost:** free
Themes:	N/A

Title:	**Agreement Between Physician's Recommendation and Fitness-to-Drive Decision in Multiple Sclerosis**
Author:	M. Ranchet, A. E. Akinwuntan, M. Tant, E. Neal and H. Devos
Published:	Archives of Physical Medicine and Rehabilitation, October 2015
Link:	http://www.archives-pmr.org/article/S0003-9993(15)00490-6/fulltext
Objectives:	To investigate the agreement of fitness-to-drive decisions made by the referring physicians and by the on-road assessors in individuals with multiple sclerosis (MS).
Methodology:	Retrospective analysis on a sample of individuals with MS (N=218) who completed the medical and driving questionnaire and performed an official on-road test. Main outcome measure: Fitness-to-drive decision made by the on-road assessor.
Key Findings: • The referring physician and on-road assessor agreed on fitness to drive in 191 (88%) of the cases (prevalence-adjusted and bias-adjusted κ=.81, P<.0001). • When compared with the on-road assessor's judgment, the physician's recommendation of fitness to drive was overestimated in 16 individuals with MS and underestimated in 11 individuals with MS. • Patients with poor binocular acuity were more likely to be inaccurately classified by the physician (P=.001). • **Conclusions:** This study showed a high level of agreement between the fitness-to-drive decisions made by the physicians and the on-road assessors in individuals with MS. Visual functions should be assessed in the doctor's office for more accurate referrals.	
Format: pdf	**Cost:** priced
Themes:	Automobile driving, Multiple sclerosis, Physician, Rehabilitation

Title:	**Assessing Chinese coach drivers' fitness to drive: The development of a toolkit based on cognition measurements**
Author:	H. Wang, X. Mo, Y. Wang, R. Liu, P. Qiu and J. Dai
Published:	Accident Analysis & Prevention, October 2016
Link:	http://www.sciencedirect.com/science/article/pii/S0001457515300762
Objectives:	To develop a cognitive toolkit to assess Chinese coach drivers' fitness to drive.
Methodology:	A total of 1413 licensed coach drivers in Jiangsu Province, China were investigated and tested.
Key Findings: • Drivers with accident history within three years performed overwhelmingly worse ($p < 0.001$) on dark adaptation, dynamic visual acuity, depth perception, attention concentration, attention span, and significantly worse ($p < 0.05$) on reaction to complex tasks compared with drivers with clear accident records. • The study developed a toolkit consisting of nine cognition measurements across driver perception/sensation, attention, and reaction. • Methods for categorizing qualified, good, and excellent coach drivers and criteria for evaluating and training Chinese coach drivers' fitness to drive were also proposed.	
Format: pdf	**Cost:** priced
Themes:	Coach driver; Fitness to drive; Cognition measurement; Kernel principal component analysis

Title:	**Assessment Tools Predicting Fitness to Drive in Older Adults: A Systematic Review**
Author:	A. E. Dickerson, D. B. Meuel, C. D. Ridenour and K. Cooper
Published:	The American Journal of Occupational Therapy, November 2014
Link:	http://ajot.aota.org/article.aspx?articleid=1934883
Objectives:	This systematic review synthesizes the research on screening and assessment tools used to determine older adults' fitness to drive.
Methodology:	A comprehensive search of the literature targeting tools commonly used by occupational therapists; 64 studies were reviewed and synthesized.
Key Findings: • A single tool measuring cognition, vision, perception, or physical ability individually is not sufficient to determine fitness to drive. • Although some tools have stronger evidence than others, this review supports using different and focused assessment tools together for specific medical conditions. • Results indicate that behind-the-wheel assessment remains the gold standard for driving evaluation; however, emerging evidence for observation of complex instrumental tasks of daily living and driving simulation supports further investigation with these tools.	
Format: pdf	**Cost:** priced
Themes:	Assessment, Driving evaluation, Driver rehabilitation, Older adults, Screening

Title:	**Determining Fitness to Drive in Older Persons: A Survey of Medical and Surgical Specialists**
Author:	S. Marshall, E. M. Demmings, A. Woolnought, D. Salim and M. Man-Son-Hing
Published:	Canadian Geriatrics Journal, December 2012
Link:	http://www.cgjonline.ca/index.php/cgj/article/view/30/92
Objectives:	To determine the attitudes and practices of Canadian specialists regarding the assessment of medical fitness to drive in older persons.
Methodology:	A postal survey of 842 physicians certified in cardiology, endocrinology, geriatric medicine, neurology, neurosurgery, orthopaedic surgery, physical medicine and rehabilitation, or rheumatology regarding their attitudes and practices relating to the assessment of their patients' fitness to drive.
Key Findings: • Except for rheumatologists (18%), most specialists reported that fitness to drive is an important issue in their practices (68%) • Confidence in the ability to assess fitness to drive was low (33%), and the majority (73%) felt they would benefit from further education • There were significant differences ($p < .05$) in responses between physicians from different provinces, owing to reporting policies • More geriatricians than neurologists report drivers with mild Alzheimer disease to authorities regardless of reporting policy (mandatory 90.7% vs. 56.0%; non-mandatory 84.1% vs. 40.0%) ($p < .05$) • **Conclusions:** Canadian specialists accept the responsibility of determining their patients' fitness to drive but are not fully confident in their ability to do so. However, they are receptive to education to improve their skills in this area.	
Format: pdf	**Cost:** priced
Themes:	Older drivers, Medical fitness to drive, Survey, Physician's role

Title:	**Developing a Canadian-Specific Version of the Fitness-to-Drive Screening Measure**
Author:	S. Classen, L. Alvarez, P. J. M. Ferreira, C. H. Chen, C. K. Meyer and A. G. Nywening
Published:	OTJR: Occupation, Participation and Health, 2016
Link:	http://journals.sagepub.com/doi/10.1177/1539449216650462
Objectives:	The objective of this article is to identify the FTDS resources/recommendations appropriate for Canadian users and the barriers that Canadian stakeholders experience when promoting older driver fitness.
Methodology:	Twenty stakeholders from three provinces (eight occupational therapists, three certified driver rehabilitation specialists, four physicians, and five members of advocacy organizations) participated in semi-structured interviews. Summative and thematic content analysis were then conducted.
Key Findings: • A comprehensive set of resources/recommendations was identified • Barriers to older driver fitness decisions included fear of losing the license, compromising the physician–client relationship, insufficient training/resources for health care professionals, and inadequate alternative transportation • Canadian context-specific resources/recommendations were integrated into a Canadian version of the FTDS. This version may better serve Canadian older drivers, caregivers, and health care professionals.	
Format: pdf	**Cost:** priced
Themes:	Fitness to drive, Aging, Screening, Automobile driving

Title:	**Driver rehabilitation: A systematic review of the types and effectiveness of interventions used by occupational therapists to improve on-road fitness-to-drive**
Author:	C. A. Unsworth and A. Baker
Published:	Accident Analysis & Prevention, October 2014
Link:	http://www.sciencedirect.com/science/article/pii/S0001457514001286
Objectives:	Driver rehabilitation has the potential to improve on-road safety and is commonly recommended to clients. The aim of this systematic review was to identify what intervention approaches are used by occupational therapists as part of driver rehabilitation programmes, and to determine the effectiveness of these interventions. Sixteen studies were included in the review.
Methodology:	Six electronic databases (MEDLINE, CINAHL, PsycInfo, Embase, The Cochrane Library, and OTDBase) were searched. Two authors independently reviewed studies reporting all types of research designs and for all patient populations, provided the interventions could be administered by occupational therapists. The methodological quality of studies was assessed using the 'Downs and Black Instrument', and the level of evidence for each intervention approach was established using 'Centre for Evidence Based Medicine' criteria.
Key Findings: • The most common type of intervention approach used was computer-based driving simulator training (n = 8), followed by off-road skill-specific training (n = 4), and off-road education programmes (n = 3). Car adaptations/modifications were used in one of the included studies • There was significant variability between studies with regards to frequency, duration, and total number of intervention sessions, and the diagnoses of the participants • Of the four intervention approaches, there is evidence to support the effectiveness of off-road skill-specific training (with older clients), and computer-based driving simulator training (with both older clients and participants with acquired brain injury) • **Conclusions**: Three types of intervention approaches are commonly reported, however, there is limited evidence to determine the effectiveness of these in improving fitness-to-drive. Further research is required, with clients from a range of diagnostic groups to establish evidence-based interventions and determine their effectiveness in improving these clients' on-road fitness-to-drive.	
Format: pdf	**Cost:** priced
Themes:	Driver intervention, Driver rehabilitation, Fitness-to-drive, On-road, Systematic review

Title:	**Fitness to drive—How well do we know the rules? Survey of 19 ENT surgeons in Wales**
Author:	D. Yap, A. Shakir, R. Costello and S. Browning
Published:	Clinical OOtolaryngology, March 2017
Link:	http://onlinelibrary.wiley.com/doi/10.1111/coa.12852/abstract
Objectives:	The aim of the audit is to assess ENT surgeons' knowledge in relation to common ENT conditions listed on the DVLA website, such as acoustic neuroma, vertigo, dizziness, Obstructive Sleep Apnea (OSA), labyrinthitis and deafness.
Methodology:	A survey was created on SurveyMonkey® with 13 true/false questions on different domains of DVLA rules. This survey was sent to ENT consultants and registrars across Wales.
Key Findings: • All respondents were aware that it is the patient's responsibility to inform the DVLA regarding their medical condition • 83% of respondents knew that Group 1 drivers with a profound hearing loss do not require the DVLA to be informed. Additionally, only 21% answered correctly that patients with a diagnosis of vertigo should contact the DVLA • 53% of the respondents were not aware that patients need to inform the DVLA if they suffer with day time sleepiness • Surprisingly, only 37% discuss driving when patients are seen in clinic with vertigo.	
Format: pdf	**Cost:** priced
Themes:	Automobile Driving, Law, Otolaryngology, Vertigo, Dizziness, Deafness

Title:	**Screening and Assessment Tools for Determining Fitness to Drive: A Review of the Literature for the Pathways Project**
Author:	A. E. Dickerson
Published:	Occupational Therapy in Health Care, March 2014
Link:	http://www.tandfonline.com/doi/abs/10.3109/07380577.2014.904535?journalCode=iohc20
Objectives:	The paper offers a comprehensive literature review of research studies that address screening and assessment for fitness to drive.
Methodology:	Review of research

Key Findings:

- 10 tables summarize the findings from the literature describing screening and assessment tools used with older adults to identify risk or determine fitness to drive
- The tables are organized into groups of key research studies of assessment tools, screening batteries, tools used in combination (i.e., as a battery), driving simulation as an assessment tool, and screening/assessment for individuals with stroke, vision impairment, Parkinson's disease, dementia, and aging
- Each table has a summary of important concepts to consider as occupational therapists choose the methods and tools to evaluate fitness to drive
- Through the use of tables, readers can better understand the research behind several types of assessment tools applicable to practice and read a summary of these findings as applied to the evaluation of fitness to drive
- An assessment tool that may be the best choice in one clinical setting (e.g., a Parkinson's disease clinic), may not be the most informative choice in another
- Readers are encouraged to use the reference tables to explore options, to review the studies of significance to their patient population and select the best measures for evaluation and referral pathways when asked to determine fitness to drive.

Format: pdf	**Cost:** priced
Themes:	Assessment, Driving evaluation, Driver rehabilitation, Older adults, Screening

Title:	**Utility of the MOCA as a cognitive predictor for fitness to drive**
Author:	P. Esser, S. Dent, C. Jones, B. J. Sheridan, A. Bradley, D. T. Wade and H. Dawes
Published:	Journal of Neurology, Neurosurgery & Psychiatry, 2015
Link:	http://jnnp.bmj.com/content/87/5/567
Objectives:	The study sets out to evaluate the potential of the Montreal Cognitive Assessment (MOCA) as a screening tool, for people with concerns regarding cognitive capacity; to determine pass/fail cut-offs for on-road driving assessment
Methodology:	People referred via various pathways (Driving and Vehicle Licensing Agency, self-referral or health professionals such as general practitioners, occupational therapists, nurses or physiotherapists), were assessed between 21 February 2013 and 31 March 2014 at the RDAC in the UK.

	The assessment is not a driving test and only those with an existing driving license (full, provisional or section 88) are included. Individuals presenting with self-indicated cognitive problems (18.9% of total assessments carried out), were assessed using the MOCA and analysed to form a subsample for analysis. A total of 243 people, were assessed by an experienced multidisciplinary team consisting of occupational therapists and driving instructors. Following a standard assessment route and criteria assessment, outcomes were classified as follows: 'Pass'—client was deemed to be able to drive safely; 'Fail'—client was not deemed safe to drive; and 'Review'—where a decision could not be taken at that point in time and more guidance/practice may be required. This study focused on those who passed or failed this assessment within largest (e.g., n>5) neurological groups found within the sample assessed during this period.
Key Findings: • The results of this research suggest that the MOCA could potentially be used as a quick cognitive screen for health practitioners to help with decision-making to determine the need for an on-road driving assessment in people self-referring with concerns regarding their cognitive capacity to drive • The findings give clear cut-offs from the MOCA for people who are likely to pass, MOCA >27, and people likely to fail, MOCA <12, on-road assessments. As such, these individuals would not benefit from an on-road driving assessment. However, individuals scoring between 12 and 27 on the MOCA have a 50/50 chance of passing, and thus referring these individuals for on the road driving assessments would appear to make good use of this resource.	
Format: pdf	**Cost:** priced
Themes:	N/A

Title:	**Variability in clinicians' opinions regarding fitness to drive in patients with obstructive sleep apnoea syndrome (OSAS)**
Author:	A. Dwarakanath, M. Twiddy, D. Ghosh, S. L. Jamson, P. D. Baxter and M. W. Elliott
Published:	British Thoracic Society, November 2014
Link:	http://thorax.bmj.com/content/70/5/495
Objectives:	**Primary objective**: To assess the degree of variation in advice a patient with OSAS might receive in everyday clinical practice at diagnosis and after starting CPAP **Secondary objectives**: To establish which factors, if any, influenced the advice given, to evaluate the use of objective tests in assessing fitness to drive and whether clinicians report patients to the DVLA.
Methodology:	Clinicians were invited to participate in a web-based survey. The survey was divided into two parts. The first was completed by all the respondents and included six vignettes that presented a variety of patients with OSAS. The second part was limited to clinicians who completed DVLA medical forms (SL2C (standard) and SL2VC (vocational)).

	Respondents were presented with further vignettes of patients who had been offered CPAP, focusing on the questions posed by the DVLA. Additional information was requested, including on the use of objective tests for assessing fitness to drive. Three sleep specialists from the BTS Specialist Advisory Group reviewed the vignettes and confirmed that they were reflective of everyday clinical practice. Respondents were reminded twice to answer as if there was a real patient before them and not how they thought they would be expected to respond.

Key Findings:

Advice given at diagnosis of OSAS

There was wide variability in the advice given by the clinicians in all the six vignettes. To a patient, what matters is whether driving is permitted or not, so for ease of presentation and analysis, responses such as 'would not give advice' and 'other' are omitted. Respondents who provided these responses were specialist nurses or non-medically qualified professionals including sleep physiologists. Conflicting advice was given by different clinicians for each vignette.

Advice given following treatment with CPAP

- **CPAP compliance**: Across the vignettes there was disagreement between clinicians regarding whether they felt the patient was compliant with CPAP; 'yes' responses ranged from 13% to 64%.
- **Residual drowsiness**: There was inconsistency in the clinicians' assessment of residual drowsiness.
- **Drivers reported to the DVLA**: Seventy-four per cent of the clinicians who completed the second part of the survey had never reported patients to the DVLA, 23% had reported one to four times and 3% had reported more than five times.
- **Use of objective tests**: One per cent of clinicians always and 4% frequently use objective tests to help in their assessment. Professional drivers are more likely to undergo objective tests than non-professional drivers (52% vs 38%, p=0.0002, OR 1.75).

Format: pdf	**Cost:** priced
Themes:	N/A

Title:	**Assessing fitness to drive—A validation study on patients with mild cognitive impairment**
Author:	B. M. Fuermaier, D. Piersma, D. de Waard, R. J. Davidse, J. de Groot, M. J. A. Doumen, R. A. Bredewoud, R. Claesen, A. W. Lemstra, P. Scheltens, A. Vermeeren, R. Ponds, F. Verhey, W. H. Brouwer and O. Tucha
Published:	Traffic Injury Prevention, 2017
Link:	http://www.tandfonline.com/doi/full/10.1080/15389588.2016.1232809
Objectives:	There is no consensus yet on how to determine which patients with cognitive impairment are able to drive a car safely and which are not. Recently, a strategy was composed for the assessment of fitness to drive, consisting of clinical interviews, a neuropsychological assessment, and driving simulator rides, which was compared with the outcome of an expert evaluation of an on-road driving assessment. A selection of tests and parameters of the new approach revealed a predictive accuracy of 97.4% for the prediction of practical fitness to drive on an initial sample of patients with Alzheimer's dementia. The aim of the present study was to explore whether the selected variables would be equally predictive (i.e., valid) for a closely related group of patients; that is, patients with mild cognitive impairment (MCI).
Methodology:	Eighteen patients with mild cognitive impairment completed the proposed approach to the measurement of fitness to drive, including clinical interviews, a neuropsychological assessment, and driving simulator rides. The criterion fitness to drive was again assessed by means of an on-road driving evaluation. The predictive validity of the fitness to drive assessment strategy was evaluated by receiver operating characteristic (ROC) analyses.
Key Findings: • Twelve patients with MCI (66.7%) passed and 6 patients (33.3%) failed the on-road driving assessment. The previously proposed approach to the measurement of fitness to drive achieved an overall predictive accuracy of 94.4% in these patients. The application of an optimal cut-off resulted in a diagnostic accuracy of 100% sensitivity towards unfit to drive and 83.3% specificity towards fit to drive. • Further analyses revealed that the neuropsychological assessment and the driving simulator rides produced rather stable prediction rates, whereas clinical interviews were not significantly predictive for practical fitness to drive in the MCI patient sample. • **Conclusions**: The selected measures of the previously proposed approach revealed adequate accuracy in identifying fitness to drive in patients with MCI. Furthermore, a combination of neuropsychological test performance and simulated driving behaviour proved to be the most valid predictor of practical fitness to drive.	
Format: pdf	**Cost:** free
Themes:	Fitness to drive, Mild cognitive impairment, Neuropsychological assessment, Driving simulator, On-road test

Title:	**Poor mental health status and aggression are associated with poor driving behaviour among male traffic offenders**
Author:	N. Abdoli, V. Farnia, A. Delavar, A. Esmaeli, F. Dortaj, N. Farroki, M. Karami, J. Shakeri, E. Holsboer-Trachsler and S. Brand
Published:	Dovepress, June 2015
Link:	https://www.dovepress.com/poor-mental-health-status-and-aggression-are-associated-with-poor-driv-peer-reviewed-article-NDT
Objectives:	The study explored the extent to which aggressive traits, health status, and sociodemographic variables explain driving behaviour among Iranian male traffic offenders.
Methodology:	A total of 443 male driving offenders (mean age: M =31.40 years, standard deviation =9.56) from Kermanshah (Iran) took part in the study. Participants completed a questionnaire booklet covering sociodemographic variables, traits of aggression, health status, and driving behaviour.
Key Findings: • Poor health status, such as symptoms of depression, anxiety, insomnia, and social dysfunction, and also higher levels of trait aggression explained poor driving behaviour • Multiple regressions indicated that poor health status, but not aggression, independently predicted poor driving behaviour • **Conclusion**: Results suggest that health status concerns are associated with poor driving behaviour. Prevention and intervention might therefore focus on drivers reporting poor mental health status.	
Format: pdf	**Cost:** free
Themes:	Insomnia, Depression, Anxiety aggression, Health status, Male traffic offenders

Title:	**Disorders Properties of the Driving Behaviour Survey among individuals with motor vehicle accident-related posttraumatic stress disorder**
Author:	J. D. Clapp, A. S. Baker, S. D. Litwack, D. M. Sloan and J. G. Beck
Published:	Journal of Anxiety Disorders, October 2013
Link:	http://linkinghub.elsevier.com/retrieve/pii/S0887618513002090?via=sd
Objectives:	The study examined the psychometric properties of Driving Behaviour Survey (DBS) scores among individuals with posttraumatic stress disorder (PTSD) subsequent to motor vehicle trauma.
Methodology:	Clinical data were collected as part of a larger study examining the efficacy of a brief written exposure intervention for individuals with MVA-related PTSD. Informed consent was obtained from community members in the larger treatment outcome study upon their arrival for initial assessment. Participants then completed a series of self-report measures and semi-structured clinical interviews. Interviews were conducted by doctoral-level psychologists. All assessments were recorded with 15% selected at random for independent review.
Key Findings: • Internal consistencies and 12-week test–retest reliabilities for DBS scales ranged from good to excellent • Comparison of scores to normative student data indicated dose–response relationships for safety/caution and performance deficit subscales, with increased frequency of anxious behaviour occurring within the PTSD sample • Associations with standard clinical measures provide additional evidence for anxiety-related driving behaviour as a unique marker of functional impairment, distinct from both avoidance and disorder-specific symptoms.	
Format: pdf	**Cost:** priced
Themes:	Driving anxiety, Driving behaviour, Motor vehicle accident, Posttraumatic stress disorder, Assessment

Title:	**Psychiatrists' responsibilities with regards to patients' fitness to drive**
Author:	M. Yaqub, S. Ismail, S. Babiker and T. S. S. Rao
Published:	Indian Journal of Psychiatry, October 2016
Link:	http://www.indianjpsychiatry.org/article.asp?issn=0019-5545;year=2016;volume=58;issue=3;spage=287;epage=290;aulast=Yaqub
Objectives:	A complete clinical audit cycle was carried out to see whether the mental health practitioners were assessing their patients' fitness to drive and addressing the issue as guided by the relevant agencies and legislation.
Methodology:	An audit tool was devised based on General Medical Council's (GMC). The following five standards were included in the audit tool: • Mental health professionals should find out whether patient is driving • Mental health professionals should discuss with patients whether it is appropriate and safe for them to continue driving • Mental health professionals should advise patients about their legal duty to inform DVLA about their condition • Mental health professionals should check with patient at follow-up whether they stopped driving after advice • Mental health professionals should check with patient at follow-up whether they informed DVLA about their condition.

Key Findings:

- Combined Audit and Re-audit results:

Standard	Compliance on Audit	Compliance on Re-audit
Medical practitioners to find out whether patient is driving	(5/40) 12.5%	(19/50) 38%
Medical practitioners to discuss with patients whether it is appropriate and safe for them to continue driving	(1/40) 2.5%	(11/50) 22%
Medical Practitioners to advise patients about their legal duty to inform DVLA about their condition	(0/40) None	(7/50) 14%
To check with patient at follow up whether they stopped driving after advice	(0/40) None	(8/50) 16%
To check with patient at follow up whether they informed DVLA about their condition	(0/40) None	(7/50) 14%

- **Conclusions**: The clinical audit demonstrated the need to improve awareness among mental health teams that they have a role, though indirectly, with regard to their patients' fitness to drive. However, confidentiality issues and lack of awareness of the guidelines in this regard are significant hindering factors to this good practice. Moreover, there may be fears of adverse effects to the therapeutic relationship with patients. These factors reflect the need for organizational level changes in practice instead of relying on individual practices.

Format: pdf	**Cost:** free

Title:	**The effect of partial sleep deprivation on computer-based measures of fitness to drive**
Author:	J. F. A. Schwarz, P. Geisler, G. Hajak, J. Zulley, R. Rupprecht, T. C. Wetter and R. F. J. Popp
Published:	Sleep and Breathing, March 2016
Link:	https://link.springer.com/article/10.1007%2Fs11325-015-1220-0
Objectives:	Using a partial sleep deprivation paradigm, the aim of the study was to investigate the sensitivity of a computer-based test battery of fitness to drive to detect impairments related to sleepiness.
Methodology:	Forty-seven healthy subjects (34 females, mean age 26.0 ± 6.8 years) participated in a counterbalanced within-subject design of two conditions: (i) normal night sleep and (ii) partial sleep deprivation (PSD) with 4 hour time in bed. For the assessment of fitness to drive, they used a validated traffic psychological test battery. Moreover, well-established measures of sleepiness highly responsive to sleep deprivation were applied: the Karolinska Sleepiness Scale (KSS), pupillography (Pupil Unrest Index (PUI) as physiological sleepiness indicator) and two sustained attention tasks (psychomotor Vigilance Task and Mackworth Clock Test).
Key Findings: • Subjective and physiological sleepiness were significantly increased after PSD, accompanied by large (d > 1.50 for KSS) and medium (d = 0.55 for PUI) effect sizes • Sleepiness-related performance decrements were found in both sustained attention tasks (d = 0.59–0.77) • Assessing driving-related ability, PSD induced decrements only in the test domain Reaction Test (reaction time d = 0.54 and motor time d = 0.45) • All other subtests—as well as the overall judgement of fitness to drive—were not significantly affected by PSD.	
Format: pdf	**Cost:** priced
Themes:	Daytime sleepiness, Partial sleep deprivation, Fitness to drive, Sustained attention

Title:	**The effect of stress and personality on dangerous driving behaviour among Chinese drivers**
Author:	Y. Ge, W. Qu, C. Jiang, F. Du, X. Sun and K. Zhang
Published:	Accident Analysis & Prevention, December 2014
Link:	http://www.sciencedirect.com/science/article/pii/S0001457514002279
Objectives:	The paper investigates the link between global stress and dangerous driving behaviour.
Methodology:	242 drivers completed the Perceived Stress Scale-10 (PSS-10), the Dula Dangerous Driving Index (DDDI), and several personality trait scales related to anger, sensation seeking, and altruism.

Key Findings:

- The results showed the positive association between global stress and anger and the mediating role of anger in the effect of global stress on both negative cognitive/emotional driving and aggressive driving behaviour
- The results replicated the previously reported association between high sensation seeking and more dangerous driving behaviour. This association is not influenced by global stress
- Drivers with a high score on the altruism measure reported less drunk driving behaviour
- The findings from this study regarding the relationship among stress, anger, and dangerous driving behaviour could be applied in the development of intervention programs for stress and anger management in order to improve drivers' ability to manage emotional thoughts and adjust their behaviour on the road.

Format: pdf	**Cost:** priced
Themes:	Stress, Anger, Sensation seeking, Altruism, Dangerous driving, Personality traits

Title:	**Validation of the Driver Stress Inventory in China: Relationship with dangerous driving behaviours**
Author:	W. Qu, Q. Zhang, W. Zhao, K. Zhang and Y. Ge
Published:	Accident Analysis & Prevention, February 2016
Link:	http://www.sciencedirect.com/science/article/pii/S0001457515301342
Objectives:	The study validates a Chinese version of the Driver Stress Inventory (DSI) and explores its correlation with dangerous driving behaviours and gender.
Methodology:	A sample of 246 drivers completed the Chinese version of the DSI and the Driver Behaviour Questionnaire (DBQ). They also evaluated specific sociodemographic variables and traffic violations (including speeding, violating traffic signs or markings, driving while intoxicated, running a red light, and incurring penalty points). A confirmatory factor analysis (CFA) verified the DSI's internal structure. The DSI was also validated using questionnaires related to the DBQ, self-reported traffic accidents and violations, and sociodemographic characteristics.
Key Findings: • The Chinese version of the Driver Stress Inventory is highly reliable and has a stable structure • Criterion validity measures demonstrate that the Chinese Driver Stress Inventory is valid • Driver stress was strongly correlated with dangerous driving behaviour • Female drivers had higher scores for disliking driving and fatigue proneness and lower hazard monitoring scores compared with male drivers.	
Format: pdf	**Cost:** priced
Themes:	Driver stress, Dangerous driving, Driving behaviour

Title:	**Cardiovascular Risk Factors of Taxi Drivers**
Author:	R. A. Elshatarat and B. J. Burgel
Published:	Journal of Urban Health, June 2016
Link:	https://link.springer.com/article/10.1007%2Fs11524-016-0045-x
Objectives:	In the United States (U.S.), cardiovascular disease (CVD) is a major leading cause of death. Despite the high mortality rate related to CVD, little is known about CVD risk factors among urban taxi drivers in the U.S. A cross-sectional design was used to identify the predictors of high cardiovascular risk factors among taxi drivers.
Methodology:	Convenience sampling method was used to recruit 130 taxi drivers. A structured questionnaire was used to obtain the data. The sample was male (94 %), age mean (45 ± 10.75) years, married (54 %), born outside of the USA (55 %), had some college or below (61.5 %), night drivers (50.8 %), and driving on average 9.7 years and 41 h/week.
Key Findings: • About 79 % of them were eligible for CVD prevention, and 35.4 % had high CVD risk factors (4–9 risk factors) • A CVD high-risk profile had a significant relationship with the subjects who were ≥55 years old; had hypertension, diabetes, or hyperlipidaemia; were drinking alcohol ≥2 times/week; and had insufficient physical activity • Subjects who worked as a taxi driver for more than 10 years (OR 4.37; 95 % CI 1.82, 10.50) and had mental exertion from cab driving >5 out of 10 (OR 2.63; 95 % CI 1.05, 6.57) were more likely to have a CVD high-risk profile • As a conclusion, system-level or worksite interventions include offering healthy food at taxi dispatching locations, creating a work culture of frequent walking breaks, and interventions focusing on smoking, physical activity, and weight management. Improving health insurance coverage for this group of workers is recommended.	
Format: pdf	**Cost:** priced
Themes:	Cardiovascular disease, Risk factors, Urban taxi drivers, San Francisco drivers

Title:	**Fitness-to-drive agreements after stroke: medical versus practical recommendations**
Author:	M. Ranchet, A. E. Akinwuntan, M. Tant, A. Salch, E. Neal and H. Devos
Published:	European Journal of Neurology, May 2016
Link:	http://onlinelibrary.wiley.com/doi/10.1111/ene.13050/abstract
Objectives:	Physicians often struggle to screen out patients who are no longer fit to drive after a stroke. The agreement between the recommendations of physicians and on-road assessors with regard to fitness to drive after a stroke was investigated.
Methodology:	In this retrospective study, 735 stroke patients underwent medical, visual and road tests at an official fitness-to-drive centre of the Belgian Road Safety Institute. Physicians provided medical fitness-to-drive recommendations using one of three categories (favourable, reserved or unfavourable). On-road assessors used the same three categories to make practical fitness-to-drive recommendations. Agreement between the medical and practical fitness-to-drive recommendations was calculated using the percentage of agreement and prevalence and bias adjusted kappa (PABAK). Area under the curve (AUC) was used to predict the medical and practical recommendations after stepwise logistic regression analyses.
Key Findings: • The percentage of agreement was 73% and the PABAK was 0.60 ($P < 0.0001$) • Physicians disagreed on 92% of patients classified as unfavourable and 80% of those classified as reserved by the on-road assessor • Previous visits to the driving centre and number of comorbidities predicted medical fitness-to-drive recommendations (AUC = 0.68) • Age, previous visits to the centre, binocular acuity and driving experience constituted the best model to predict practical fitness-to-drive recommendations (AUC = 0.70). • **Conclusions**: Although there was a moderate agreement between the medical and practical fitness-to-drive recommendations, physicians were less likely to screen out those patients who may pose an actual risk on the road. Demographic, clinical and driving factors differently affected the medical and practical fitness-to-drive recommendations.	
Format: pdf	**Cost:** priced
Themes:	Driving, On-road assessors, Physicians, Stroke

Title:	**Impact of New Guidelines and Educational Program on Awareness of Medical Fitness to Drive Among General Practitioners in Ireland**
Author:	A. Kahvedzic, R. Mcfadden, G. Cummings, D. Carr and D. O'Neil
Published:	Traffic Injury Prevention, October 2014
Link:	http://www.tandfonline.com/doi/abs/10.1080/15389588.2014.979408?journalCode=gcpi20
Objectives:	To investigate changes in attitudes, resources, and practices of general practitioners (GPs) toward evaluating medical fitness to drive (MFTD) following the publication of national guidelines and an extensive educational programme in traffic medicine.
Methodology:	Postal questionnaire survey to GPs (n = 1,000) in November 2013.
Key Findings: • The final response rate was 46% • GPs are confident (57%) or very confident (14%) in assessing MFTD • There is a high awareness of the new Irish guidelines, with 86% of GPs using them for assistance in assessing MFTD • GPs are divided as to whether GPs (49%) or practitioners specially trained to assess MFTD (44%) should be primarily responsible for assessing MFTD • GPs expressed interest in traffic medicine educational programs, most notably a resource pack for continuous medical education (CME) Small Group learning (87%), MFTD software (71%), and an online module (68%). Many (68%) remain concerned about their liability in regard to MFTD assessments. • **Conclusion**: Irish GPs are confident in assessing MFTD and show a high level of awareness of the new guidelines. There is a clear interest among GPs in further educational supports and training in traffic medicine, particularly MFTD assessments.	
Format: pdf	**Cost:** priced
Themes:	Medical fitness to drive, Guidelines, General practitioners, Education programs, Safety, Assessment

Title:	**Serum nitrotyrosine and psychometric tests as indicators of impaired fitness to drive in cirrhotic patients with minimal hepatic encephalopathy**
Author:	V. Felipo, A. Urios, P. Valero, M. Sanchez, M. A. Serra, I. Pareja, F. Rodriguez, C. Gimenez-Garzo, J. Sanmartin and C. Montoliu
Published:	Liver International, May 2013
Link:	http://onlinelibrary.wiley.com/doi/10.1111/liv.12206/abstract
Objectives:	Cirrhotic patients with minimal hepatic encephalopathy (MHE) show impaired driving ability and increased vehicle accidents. The neurological deficits contributing to impaired driving and the underlying mechanisms are poorly understood. Early detection of driving impairment would help to reduce traffic accidents in MHE patients. It would therefore be useful to have psychometric or biochemical parameters reflecting driving impairment. The aims of this work were as follows: (i) to shed light on the neurological deficits contributing to impaired driving; (ii) to assess whether some psychometric test or biochemical parameter is a good indicator of driving impairment.
Methodology:	Were assessed in 22 controls, 36 cirrhotic patients without and 15 with MHE, driving performance using a driving simulator (SIMUVEG) and Driver Test. MHE was diagnosed using the psychometric hepatic encephalopathy score (PHES). Psychometric tests assessing different neurological functions (mental processing speed, attention, visuo-spatial and bimanual coordination) were performed. Blood ammonia and parameters related with nitric oxide-cGMP metabolism, IL-6, IL-18 and 3-nitrotyrosine were measured.
Key Findings: • Patients with MHE showed impaired driving ability correlating with MHE grade, with impaired vehicle lateral control in spite of reduced driving speed • Patients with MHE show psychomotor slowing, longer reaction times, impaired bimanual and visuo-spatial coordination and concentrated attention and slowed speed of anticipation and increased blood ammonia, cGMP, IL-6, IL-18 and 3-nitrotyrosine • **Conclusions**: Impaired mental processing speed, attention and alterations in visuo-spatial and motor coordination seem main contributors to impaired driving ability in patients with MHE. Increased serum 3-nitrotyrosine is associated with impaired driving ability.	
Format: pdf	**Cost:** priced
Themes:	3-nitrotyrosine, Fitness to drive, Minimal hepatic encephalopathy, Psychometric tests

Title:	**The conundrum of eclampsia and fitness to drive**
Author:	H. L. Barrett, M. N. Dekker, K. Lust, N. Fagermo, P. Wolski and L. K. Callaway
Published:	Australian and New Zealand Journal of Obstetrics and Gynaecology, November 2013
Link:	http://onlinelibrary.wiley.com/doi/10.1111/ajo.12139/abstract
Objectives:	The study aimed to assess what advice healthcare professionals involved in the peripartum care of women provide to women who have an eclamptic seizure, what investigations they would conduct to exclude other causes of seizures and their level of awareness of whether eclampsia was addressed in the Australian Fitness to Drive guidelines.
Methodology:	A survey of 165 (response rate 66.1%) healthcare professionals attending the 2012 Society of Obstetric Medicine of Australia and New Zealand annual scientific meeting. Participants included registered nurses, midwives, consultant obstetricians, consultant physicians, doctors in training and others, interested in medical disorders of pregnancy.
Key Findings: • 46 respondents (42.2%) had never considered the issue of driving after an eclamptic seizure • For those who had considered the issue, advice ranged from no restriction (n = 5, 4.6%), no driving for 1–2 weeks (n = 14, 12.8%), no driving for 3 months (n = 20, 18.4%) or no driving for 6 months (n = 6, 5.5%). • **Conclusions**: Many healthcare professionals caring for women with peripartum seizures have not considered issues relating to fitness to drive after an eclamptic seizure. There is a wide range of advice provided. Better prospective data are required regarding the risk of subsequent seizure after eclampsia, to inform clear fitness to drive guidelines.	
Format: pdf	**Cost:** priced
Themes:	Driving guidelines, Eclampsia, Epilepsy, Peripartum seizures

Title:	**Visual-cognitive tools used to determine fitness-to-drive may reflect normal aging**
Author:	M. Bedard, S. Campbell, J. Riendeau, H. Maxwell and B. Weaver
Published:	Clinical and Experimental Optometry, August 2016
Link:	http://onlinelibrary.wiley.com/doi/10.1111/cxo.12433/abstract
Objectives:	The purpose of the study was to investigate whether age is correlated with scores on visual-cognitive tests when the full age range is examined.
Methodology:	The study recruited 114 drivers aged 18 to 89 years (mean: 42.30 ± 26.50 years). Participants completed several visual-cognitive tools often used to examine fitness-to-drive (Trail Making Tests A and B, Attention Network Test and 'useful field of view').
Key Findings: • Test scores may reflect age-associated normal biological changes • These results have implications for predicting fitness-to-drive among older drivers and suggest caution in using these scores.	
Format: pdf	**Cost:** priced
Themes:	Age, Cognition, Driver's vision, Tests

Title:	**Clinician Effectiveness in Assessing Fitness to Drive of Medically At-Risk Older Adults**
Author:	T. M. Meuser, M. Berg-Weger, D. B. Carr, S. Shi and D. Stewart
Published:	Journal of the American Geriatrics Society, April 2016
Link:	http://onlinelibrary.wiley.com/doi/10.1111/jgs.14022/abstract
Objectives:	To model the relative contributions of driver data and clinical judgments to clinical ratings of driver capability for a state licensing authority and to compare ratings with on-road test results.
Methodology:	Adults aged 60 and older (N = 652; 52% male) evaluated by a physician of their choosing and a portion subsequently road tested (n = 286). Retrospective, logistic regression.
Key Findings: • Three variables in the model were significant in the expected direction: disease functional severity for driving (odds ratio (OR = 6.65), insight (OR = 2.35), and age (OR = 1.06) • Proportionately more drivers rated likely capable (73%) passed the road test than those rated unclear or not capable (62%). • **Conclusion**: Judgments of disease severity, decrements in driver insight, and older age influenced clinician ratings of driving capability. Correspondence of physician ratings to on-road test outcomes was imperfect, highlighting the complexities in translation of clinical judgments to on-road performance. Both means of assessment have important and additive roles in driver licensing.	
Format: pdf	**Cost:** priced
Themes:	Older driver, Medical fitness to drive, Driving assessment, Driver licensing

Title:	**Caregivers' Impressions Predicting Fitness to Drive in Persons with Parkinson's**
Author:	S. Classen, L. Alvarez
Published:	OTJR: Occupation, Participation and Health, 2016
Link:	http://journals.sagepub.com/doi/pdf/10.1177/1539449215601117
Objectives:	Parkinson's disease (PD) is a common neurodegenerative disease, increasing in incidence, with a known impact on fitness to drive. Although great progress has been made on evidence-based guidelines for assessing fitness to drive of persons with PD, a need remains for early identification of at-risk drivers in need of comprehensive assessment. This study investigated whether caregivers of drivers with PD could predict the driver's on-road outcome. The study also investigated whether the predictive value of their impressions differed from that of drivers themselves, their neurologist, or from information provided by standardized measures of visual and divided attention.
Methodology:	One hundred one participants (age = 35-89 years) diagnosed with PD by a neurologist/MD specialist were recruited from the University of Florida's Centre for Movement Disorders & Neuro-restoration (UFMDC). Accompanying caregivers, for all study participants, provided their impression of the driver's fitness to drive abilities and whether or not they thought the participant would pass an on-road assessment. The referring neurologists/MD specialists also provided their risk impression for each of their patients involved in the study. Participants drove a 45-min predetermined standardized course with established reliability and validity.
Key Findings: • Caregivers' risk impressions (odds ratio [OR] = 13.76, p = .03) and Trail Making Test Part B (Trails B; OR = 0.41, p = .02) emerged as significant predictors of passing an on-road assessment • The findings suggest that caregiver impressions, with a measure of set shifting, may be used as an efficient screen to identify drivers with PD who are potentially at risk for failing an on-road assessment.	
Format: pdf	**Cost:** priced
Themes:	Driving, Parkinson's disease, Caregivers

Title:	**Driving Errors in Parkinson's Disease: Moving Closer to Predicting On-Road Outcomes**
Author:	S. Classen, B, Brumback, M. Monahan, I. I. Malaty, R. L. Rodriguez, M. S. Okun and N. R. McFarland
Published:	American Journal of Occupational Therapy, February 2014
Link:	http://ajot.aota.org/article.aspx?articleid=1863118
Objectives:	Results from studies are unclear on the specific driving errors that underlie passing or failing an on-road assessment. The study determined the between-group differences and quantified the on-road driving errors that predicted pass or fail on-road outcomes.
Methodology:	On road tests with 101 drivers with PD (mean age = 69.38 ± 7.43) and 138 healthy control (HC) drivers (mean age = 71.76 ± 5.08).
Key Findings: • Drivers with PD failed the on-road test to a greater extent than HC drivers (41% vs. 9%), HC N = 138, PD N = 99, $p < .001$ • The driving errors predicting on-road pass or fail outcomes were made in visual scanning, signalling, vehicle positioning, speeding (mainly under-speeding, $t(61) = 7.004$, $p < .001$), and total errors.	
Format: pdf	**Cost:** priced
Themes:	N/A

Title:	**Physicians' role in the determination of fitness to drive in patients with Parkinson's disease: systematic review of the assessment tools and a call for national guidelines**
Author:	O. Jitkritsadakul and R. Bhidayasiri
Published:	Journal of Clinical Movement Disorders, October 2016
Link:	https://clinicalmovementdisorders.biomedcentral.com/articles/10.1186/s40734-016-0043-x
Objectives:	To identify relevant literature on driving assessment tools in patients with PD by performing a systematic review on this subject in order to provide background information for physicians on what types of driving assessment are available, and to delineate the role of physicians in providing fitness to drive recommendations.
Methodology:	Of 1,490 abstracts screened, 55 articles fulfilled the selection criteria that investigated assessment of driving ability in PD patients with questionnaires, off-road testing battery, driving simulators, and driving skill tests (on-road tests and naturalistic driving test). Despite different methodology across studies, PD patients were observed to commit more driving errors than controls. Poor driving performance correlated with motor, visual, and cognitive severity. Excessive daytime somnolence was common in PD drivers and the presence of falling asleep while driving was identified to be a significant predictor of car accidents.
Key Findings: • Although the evidence indicated more driving errors among PD drivers as identified by various assessment tools, the extent to which physicians should be involved in the evaluation process and make related recommendations remain unclear • Driving safety is an important public health issue in PD that needs better-defined specific legal and medical guidelines • National guidelines that establish risk assessment protocols involving multidisciplinary assessments are needed to assist physicians in making appropriate referrals for additional evaluations and recommendations when patients are deemed to be unsafe drivers.	
Format: pdf	**Cost:** free
Themes:	Parkinson's disease, Driving, Fitness to drive, Driving competency

Title:	**Postural/Gait and Cognitive Function as Predictors of Driving Performance in Parkinson's Disease**
Author:	A. M. Crizzle, S. Classen, D. N. Lanford, I. A. Malaty, M. S. Okun, Y. Wang, A. Wagle Shukla, R. L. Rodriguez and N. R. McFarland
Published:	Journal of Parkinson's Disease, 2013
Link:	http://content.iospress.com/articles/journal-of-parkinsons-disease/jpd120152
Objectives:	The study aimed to determine which of three measures utilized in PD, the Unified Parkinson's Disease Rating Scale (UPDRS) motor section; the Modified Hoehn and Yahr; and the Rapid Paced Walk Test would best predict pass/fail outcomes on a road test in a sample of PD drivers.
Methodology:	All participants (N = 55; 79% men) completed a road test. Receiver Operating Characteristics were then contrasted for all subjects based on assessments from all three disease severity indices. MMSE scores were then modelled with significant disease severity measures (if any) to determine if the predictive accuracy could be improved.
Key Findings: • The Rapid Paced Walk Test and the Modified Hoehn & Yahr both predicted pass/fail outcomes on the road test (Area under the curve of 0.73 and 0.82, respectively); UPDRS motor scores, however, did not predict safe driving • When optimal cut-off points on the Modified Hoehn & Yahr (≥2.5) and Rapid Paced Walk Test (>6.22 seconds) were modelled with MMSE scores indicative of mild cognitive impairment (<27), the model accurately classified 92% and 100% as failing the road test, respectively • **Conclusion**: Although the Rapid Paced Walk Test had a slight advantage in differentiating between pass/fail outcomes compared to the Modified Hoehn & Yahr, both tests alone cannot be used in isolation to predict driving safety. Predictive accuracy can be improved using both select cut-off points on the Modified Hoehn & Yahr and Rapid Paced Walk test with MMSE scores in PD drivers. Though these findings are useful, an on-road test is still the gold standard, and screening should always be followed by formal testing.	
Format: pdf	**Cost:** priced
Themes:	Automobile driving, Parkinson's disease, Gait/postural balance, Cognition

Title:	**Validation of a screening battery to predict driving fitness in people with Parkinson's disease**
Author:	H. Devos, W. Vandenberghe, A. Nieuwboer, M. Tant, W. De Weerdt, J. D. Dawson, E. Y. Uc
Published:	Management Disorders, February 2013
Link:	http://onlinelibrary.wiley.com/doi/10.1002/mds.25387/abstract
Objectives:	The authors previously developed a short clinical battery, consisting of contrast sensitivity, Clinical Dementia Rating, the Unified Parkinson's Disease Rating Scale-motor section (UPDRS III), and disease duration, which correctly classified 90% of drivers with Parkinson's Disease (PD). The aim of this study was to validate that screening battery in a different sample of PD drivers.
Methodology:	Sixty drivers with PD were enrolled to validate the original screening battery to predict driving fitness decisions (pass–fail) by a state agency where drivers underwent detailed visual, cognitive, and on-road testing.
Key Findings: • Twenty-four participants (40%) failed the driving evaluation. The screening battery correctly classified 46 (77%) participants (sensitivity and negative predictive value = 96%; specificity and positive predictive value = 64%) • Adding other clinical predictors (e.g., age of onset, Hoehn-Yahr stage instead of UPDRS III) failed to improve the specificity of the model when the sensitivity was kept constant at 96%. However, a driving simulator evaluation improved the specificity of the model to 94%. • **Conclusions**: The original clinical battery proved to be a valid screening tool that accurately identifies fit drivers with PD and select those who need more detailed testing at specialized centres.	
Format: pdf	**Cost:** priced
Themes:	N/A

Title:	**Prediction of Fitness to Drive in Patients with Alzheimer's Dementia**
Author:	D. Piersma, A. B. M. Fuermaier, D. de Waard, R. J. Davidse, J. de Groot, M. J. A. Doumen, R. A. Bredewoud, R. Claesen, A. W. Lemstra, A. Vermeeren, R. Ponds, F. Verhey, W. H. Brouwer, O. Tucha
Published:	New York University School of Medicine, February 2016
Link:	http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0149566
Objectives:	The aim of the study is to develop a method to assess fitness to drive in a clinical setting, using three types of assessments, i.e. clinical interviews, neuropsychological assessment and driving simulator rides. The goals are: (1) to determine for each type of assessment which combination of measures is most predictive for on-road driving performance, (2) to compare the predictive value of clinical interviews, neuropsychological assessment and driving simulator evaluation and (3) to determine which combination of these assessments provides the best prediction of fitness to drive.
Methodology:	Eighty-one patients with AD and 45 healthy individuals participated. All participated in a clinical interview, and were administered a neuropsychological test battery and a driving simulator ride (predictors). The criterion fitness to drive was determined in an on-road driving assessment by experts of the CBR Dutch driving test organisation according to their official protocol. The validity of the predictors to determine fitness to drive was explored by means of logistic regression analyses, discriminant function analyses, as well as receiver operating curve analyses.
Key Findings: • All three types of assessments are predictive of on-road driving performance. Neuropsychological assessment had the highest classification accuracy followed by driving simulator rides and clinical interviews • However, combining all three types of assessments yielded the best prediction for fitness to drive in patients with AD with an overall accuracy of 92.7%, which makes this method highly valid for assessing fitness to drive in AD. This method may be used to advise patients with AD and their family members about fitness to drive.	
Format: pdf	**Cost:** free
Themes:	N/A

Title:	**Fitness to drive — When all may not be as it seems**
Author:	R. G. Beran, V. Patel
Published:	Epilepsy & Behaviour, September 2016
Link:	http://www.epilepsybehavior.com/article/S1525-5050(16)30159-7/fulltext
Objectives:	A case study that seeks to demonstrate how correct procedure can protect both the doctor and patient and their relationship, as well as the society in which they live.
Methodology:	Case study
Key Findings: • Recommendation to the DLA, concerning fitness to drive, is a very important function of those who treat people with epilepsy • What this case conveys is that those doctors who are responsible to give such advice must be in control of all the facts, something that is not always possible • This underscores the need to have a good relationship between doctors and the DLA, because it is ultimately the DLA which does have access to all reports and hence must take responsibility to make the final decision as to the outcome of each individual case.	
Format: pdf	**Cost:** priced
Themes:	N/A

Title:	**Associations Between Visual, Hearing, and Dual Sensory Impairments and History of Motor Vehicle Collision Involvement of Older Drivers**
Author:	K. A. Green, G. McGwin and C. Owsley
Published:	Journal of the American Geriatrics Society, January 2013
Link:	http://onlinelibrary.wiley.com/doi/10.1111/jgs.12091/abstract
Objectives:	To examine the association between visual and hearing impairment and motor vehicle collision (MVC) involvement in older drivers.
Methodology:	Retrospective cohort study. Population-based sample of 2,000 licensed-drivers aged 70 and older. Visual acuity was measured using the Electronic Visual Acuity test. Contrast sensitivity was measured using the Pelli-Robson chart. Presence of subjective hearing loss and other health conditions were determined using a general health questionnaire. Information regarding MVCs for all participants spanning the 5 years before study enrolment was obtained from the Alabama Department of Public Safety.
Key Findings: • After adjustment for age, race, sex, number of miles driven, number of medical conditions, general cognitive status, and visual processing speed, older drivers with visual acuity and hearing impairment (rate ratio (RR) = 1.52, 95% confidence interval (CI) = 1.01–2.30), contrast sensitivity impairment alone (RR = 1.42, 95% CI = 1.00–2.02), and contrast sensitivity and hearing impairment (RR = 2.41, 95% CI = 1.62–3.57) had higher MVC rates than drivers with no visual or hearing impairments • Drivers with visual acuity loss alone or hearing loss alone did not have MVC rates that were significantly different from those of the no impairment group after adjustment for multiple variables • **Conclusion**: Older drivers with dual sensory impairment are at greater MVC risk than those with a visual acuity or hearing deficit alone. A combined screening approach of screening for hearing and visual impairment may be a useful tool to identify older drivers at risk of MVC involvement.	
Format: pdf	**Cost:** priced
Themes:	Driver safety, Dual sensory impairment, Vision impairment, Hearing impairment

Title:	**Cognitive Tests and Determining Fitness to Drive in Dementia: A Systematic Review**
Author:	J. M. Bennett, E. Chekaluk and J. Batchelor
Published:	Journal of the American Geriatrics Society, June 2016
Link:	http://onlinelibrary.wiley.com/doi/10.1111/jgs.14180/abstract
Objectives:	The review is the first to examine cognitive test results pertaining only to individuals with dementia. The aim was to examine the relationship between cognitive tests and driving, to determine whether a cognitive assessment can be implemented as a tool to examine driver safety.
Methodology:	A systematic review of 28 studies investigating the relationship between cognitive functioning and driving in individuals with dementia was conducted.

Key Findings:

- The results of this review demonstrated a lack of consistency in the findings, with some studies showing a relationship between cognitive testing and driving performance for individuals with dementia, whereas others did not
- Results relating to individual cognitive tests and measures confined to a single cognitive domain were variable and not consistently associated with driving performance
- Studies consistently found that composite batteries predicted driving performance
- The findings from this review support the use of composite batteries comprising multiple individual tests from different cognitive domains in predicting driving performance for individuals with dementia
- Scores on individual tests or tests of a single cognitive domain did not predict driver safety
- The composite batteries that researchers have examined are not clinically usable because they lack the ability to discriminate sufficiently between safe and unsafe drivers
- Researchers need to develop a reliable, valid composite battery that can correctly determine driver safety in individuals with dementia.

Format: pdf	**Cost:** priced
Themes:	Dementia, Driving, Cognitive assessment

Title:	**Comparison of assessments of fitness to drive for people with dementia**
Author:	K. Vella and N. B. Lincoln
Published:	Neuropsychological Rehabilitation, May 2014
Link:	http://www.tandfonline.com/doi/abs/10.1080/09602011.2014.903197
Objectives:	Cognitive tests are used to inform recommendations about the fitness to drive of people with dementia. The Rookwood Driving Battery (RDB) and Dementia Drivers' Screening Assessment (DDSA) are neuropsychological batteries designed to assist in this process. The aim was to assess the concordance between the classifications (pass/fail) of the RDB and DDSA in individuals with dementia, and to compare any discordant classifications against on-road driving ability.
Methodology:	Participants were identified by community mental health teams and psychiatrists. Twenty-four participants were recruited. The mean age was 74.1 (SD 8.9) years and 18 (75%) were men. Each participant was assessed on the RDB and DDSA in an order determined by random allocation. Those with discrepant results also had an on-road assessment.
Key Findings: • The agreement between the tests was 54% using a cut-off of > 6 on the RDB, and 75% using the cut-off to > 10 on the RDB • Three participants with discrepant results agreed to be assessed on the road and all were found to be safe to drive • The findings suggested that there was poor concurrent validity between the RDB and DDSA. This raises questions about the choice of assessments in making clinical recommendations about fitness to drive in people with dementia.	
Format: pdf	**Cost:** priced
Themes:	Cognition, Driving, Dementia, Assessment

Title:	**Driving and dementia: a clinical decision pathway**
Author:	K. Carter, S. Monaghan, J. O'Brien, A. Teodorczuk, U. Mosimann and J.-P. Taylor
Published:	International Journal of Geriatric Psychiatry, May 2014
Link:	http://onlinelibrary.wiley.com/doi/10.1002/gps.4132/abstract
Objectives:	The study aimed to develop a pathway to bring together current UK legislation, good clinical practice and appropriate management strategies that could be applied across a range of healthcare settings.
Methodology:	The pathway was constructed by a multidisciplinary clinical team based in a busy Memory Assessment Service. A process of successive iteration was used to develop the pathway, with input and refinement provided via survey and small group meetings with individuals from a wide range of regional clinical networks and diverse clinical backgrounds as well as discussion with mobility centres and Forum of Mobility Centres, UK.
Key Findings: • By integrating the latest guidance from diverse roles within older people's health services and key experts in the field, the resulting pathway reflects up-to-date policy and encompasses differing perspectives and good practice • It is potentially a generalizable pathway that can be easily adaptable for use internationally, by replacing UK legislation for local regulations • A limitation of this pathway is that it does not address the concern of mild cognitive impairment and how this condition relates to driving safety.	
Format: pdf	**Cost:** priced
Themes:	Driving, Dementia, Pathway, Ageing

Title:	**Driving and dementia: a clinical update for mental health professionals**
Author:	C. L Allan, S. Behrman, N. Baruch and K. P Ebmeier
Published:	Evidence-Based Mental Health, October 2016
Link:	http://ebmh.bmj.com/content/19/4/110
Objectives:	Review the current guidelines and evidence relating to driving and dementia to help clinicians answer questions about driving safety and to consider the full range of assessment tools available.
Methodology:	Review
Key Findings: • Clinicians are generally unable to predict driving ability accurately • Clinical assessment alone should not be used to determine driving ability • Individual cognitive tests and screening tools (e.g. MMSE or MoCA) do not provide a reliable assessment of driving safety • Composite tests of memory, attention, visuo-spatial and executive function may assist in the assessments of driving safety, but there is no consensus on cut-off scores relevant to driving • Combining clinical assessment, cognitive tests and an on-road driving test provides the most accurate assessment of driving ability.	
Format: pdf	**Cost:** free
Themes:	N/A

Title:	**Driving Errors in Persons with Dementia**
Author:	P. P. Barco, C. M. Baum, B. R. Ott, S. Ice, A. Johnson, M. Wallendorf and D. B. Carr
Published:	Journal of the American Geriatrics Society, July 2015
Link:	http://onlinelibrary.wiley.com/doi/10.1111/jgs.13508/abstract
Objectives:	To differentiate driving errors in persons with dementia who fail a performance- based road test from errors in persons who pass.
Methodology:	Cross-sectional. Active drivers diagnosed with dementia (n = 60) and older adult controls (n = 32). All participants completed a standardized clinical and on-road driving assessment. The outcome variable was the number and types of driving errors according to the Record of Driving Errors (RODE), a standardized tool to record driving errors.

Key Findings:

- Sixty-two percent (n = 37) of individuals with dementia and 3% (n = 1) of controls failed the road test
- Based on the RODE, individuals with dementia made twice as many driving errors as healthy controls
- Within the dementia sample, individuals who failed the road test had more difficulties driving straight and making left and right turns than during lane changes
- Dangerous actions occurred most often while driving straight and making left turns
- Specific driving behaviours associated with road test failure in the sample with dementia included difficulties in lane positioning and usage, stopping the vehicle appropriately, attention, decision-making, and following rules of the road
- Informants of participants with dementia who failed the road test reported more impairment with cognitive functioning on the Assessing Dementia 8 Screening Interview (AD8).
- **Conclusion**: The report highlights the driving errors most common in people with dementia who fail a road test
- The finding that most of the dangerous actions in the sample with dementia occurred while driving straight is novel
- Driving on straight roads has not been considered a condition of “high challenge” in prior driving studies in individuals with dementia
- This finding has potential implications for future interventions related to vehicle instrumentation and driving recommendations for people with dementia.

Format: pdf	**Cost:** priced
Themes:	Driving performance, Dementia, Older drivers, Driving errors

Title:	**Driving with Dementia: Evaluation, Referral, and Resources**
Author:	A. E. Dickerson
Published:	Occupational Therapy in Health Care, December 2013
Link:	http://www.tandfonline.com/doi/abs/10.3109/07380577.2013.867091?journalCode=iohc20
Objectives:	The paper discusses the issues associated with driving and older adults, including the difficulty of identifying when it is time to give up the keys.
Methodology:	A review of the latest research and need for specialized services for those with diminished capacity.
Key Findings: • The paper highlights how general practice occupational therapists must work in conjunction with driver rehabilitation specialists to meet the need of this growing population • A framework for referral and judgment is described and resources offered to practitioners to use.	
Format: pdf	**Cost:** priced
Themes:	Dementia, Driver rehabilitation specialists, Driving, Driving evaluation, Older adults

Title:	**Fitness-to-drive Disagreements in Individuals with Dementia**
Author:	M. Ranchet, M. Tant, A. E. Akinwuntan, J. C. Morgan and H. Devos
Published:	Oxford University Press on behalf of The Gerontological Society of America, August 2016
Link:	https://academic.oup.com/gerontologist/article-abstract/doi/10.1093/geront/gnw119/2632142/Fitness-to-drive-Disagreements-in-Individuals-With?redirectedFrom=fulltext
Objectives:	To investigate the agreement between medical and practical fitness-to-drive recommendations in active drivers with dementia.
Methodology:	Retrospective study. 68 patients underwent medical, visual, and road tests at an official centre of the Belgian Road Safety Institute. Physicians provided medical fitness-to-drive recommendations using 1 of 3 categories (favourable, reserved, or unfavourable). On-road assessors used the same 3 categories to make practical fitness-to-drive recommendations. Agreement between the medical and practical fitness-to-drive recommendations was calculated using the percentage of agreement (p0) and weighted kappa (kw).
Key Findings: • Low agreement was found between physicians and on-road assessors regarding their fitness-to-drive recommendations (p0 = 43%, kw = 0.11, p = .20) • Compared with the on-road assessors, the physicians overestimated the fitness to drive of 24 (35%) patients and underestimated the fitness to drive of 15 (22%) patients • Patients who incurred more traffic violations were more likely to be overestimated than underestimated by the physician (p = .03) • **Implications**: This study showed disagreements between the fitness-to-drive recommendations made by the physicians and the on-road assessors in more than half of drivers with dementia. Efforts need to be made to improve the communication between physicians and on-road assessors for joint decision making of fitness to drive in dementia.	
Format: pdf	**Cost:** priced
Themes:	Driving, On-road assessors, Physicians, Stroke

Title:	**Fit to Drive?**
Author:	O. Carsten, D. Campsall, N. Christie and R. Tunbridge
Published:	PACTS Road User Behaviour Working Party, March 2016
Link:	http://www.pacts.org.uk/2016/03/fit-to-drive/
Objectives:	This report examines the research evidence and current practice in Great Britain on fitness to drive. It covers a wide range of impairments, including ones that are relatively long-term for the individual (such as physical and cognitive impairments) and the short-term ones that can be sometimes be related to individual behaviour and choice (for example alcohol consumption and fatigue).
Methodology:	For each type of impairment, there is a discussion of how that impairment affects risk in driving. Where appropriate, this is followed by a review of interventions to manage and control those risks. Finally, there is a discussion of implications for policy.

Key Findings:

- **Recommendations (**relevant for the topic**)**:
- There needs to be standard care pathway adopted in clinical settings which helps manage the safe mobility of people with cognitive impairment. Where the driver is recommended to cease driving they need to be supported with alternatives to maintain mobility and avoid social exclusion
- Given the potential underreporting of illnesses and injuries which affect cognitive impairment to the DVLA, there is a need for a protocol for GPs and other health professionals to discuss fitness to drive with their patients. However, it is important that these health professionals are not, and should not appear to their patients to be, responsible for deciding whether a licence is to be revoked
- There should be joint work by the College of Occupational Therapists, Forum of Mobility Centres, clinical commissioning groups and the road safety profession to look at current provision of off-road and on-road assessment for drivers with functional limitations with a view to building capacity in the relevant professions
- There are particular responsibilities for employers in ensuring the fitness of their employees to drive, and HSE needs to take a far more active role here. Currently no central government agency or department is taking responsibility in this crucial area
- Find out whether GPs actually know about the DVLA advice
- With increased levels of prescription medicines, research should be commissioned to look in more detail at any potential associated risks
- Research is needed into developing a clinically viable desk based assessment of driving safety
- DfT should work with third sector stakeholders to conduct a feasibility study on delivery of a physical conditioning programme to drivers most likely to suffer from functional limitations based on age and disability
- Highways England and the other strategic road authorities should look at whether there are design treatments that can ameliorate monotonous road design.

Format: pdf	**Cost:** free
Themes:	N/A

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