



Interventions to evaluate fitness to drive among people with chronic conditions: Systematic review of literature

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ARTICLE INFO

Article history:

Received 7 October 2011
Received in revised form 8 March 2012
Accepted 3 May 2012

Keywords:

Fitness to drive
Chronic diseases
Driving performance
Screening test
Neuropsychological tests
Accident prevention

ABSTRACT

When an health condition has been identified, the question of whether to continue driving depends not on a medical diagnosis, but on the functional consequences of the illness. The complex nature of physical and mental impairments and their relationship with safe driving make the availability of evidence based tools necessary for health professionals.

The review aims at identifying and summarizing scientific findings concerning the relationship between neuropsychological and clinical screening tests and fitness to drive among people with chronic conditions.

Studies were searched for driving ability evaluation by road test or simulator, clinical/neuropsychological examinations of participants with chronic diseases or permanent disablement impairing driving performance, primary outcomes as fatal/non-fatal traffic injuries and secondary outcomes as fitness to drive assessment.

Twenty-seven studies fulfilled the inclusion criteria. Some studies included more than one clinical condition. The illness investigated were Alzheimer Disease ($n=6$), Parkinson Disease ($n=8$), Cardiovascular Accident ($n=4$), Traumatic Brain Injuries ($n=3$), Sleep Apnea Syndrome ($n=2$), Narcolepsy ($n=1$), Multiple Sclerosis ($n=1$) and Hepatic Encephalopathy ($n=1$), comorbidities ($n=3$). No studies match inclusion criteria about Myasthenia Gravis, Diabetes Mellitus, Renal Diseases, Hearing Disorders and Sight Diseases. No studies referred to primary outcomes.

The selected studies provided opposite evidences. It would be reasonable to argue that some clinical and neuropsychological tests are effective in predicting fitness to drive even if contrasting results support that driving performance decreases as a function of clinical and neuropsychological decline in some chronic diseases. Nevertheless we found no evidence that clinical and neuropsychological screening tests would lead to a reduction in motor vehicle crashes involving chronic disabled drivers.

It seems necessary to develop tests with proven validity for identifying high-risk drivers so that physicians can provide guidance to their patients in chronic conditions, and also to medical advisory boards working with licensing offices.

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1. Introduction

Driving a motor vehicle is a complex activity that requires different skills, such as physical abilities, proper judgement, perception and response time. A wide range of acute and chronic medical

conditions, as well as pharmaceutical treatments, may impair any of these determinants. Such impairments may negatively affect fitness to drive and the reduced driving ability can possibly result in a crash causing injury or even death (Austroads, 2006).

Although many other factors contribute to road safety, the driver's health is an important prerequisite and drivers must meet certain medical standards associated with lower road crash risk.

There is a considerable concern about driving risks in people with known medical conditions. A recent study by the National Highway Traffic Safety Administration (Refaat, 2009) indicated that drivers with medical conditions cause around 20,000 car accidents every year, that represent 1.3% of all accidents. Indeed, the association between suffering for a chronic medical condition and being involved in a motor vehicle crash has been proved (Truls, 2003).

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The international attention has been posed on the potential for a set of clinical conditions to be associated with serious impairment and the need to establish and apply common medical standard (Austroads, 2006; Canadian Medical Association, 2006).

The licensing process is based on the full assessment of health conditions and driving performance. Different evaluation processes of fitness to drive are in place around the countries for release/renewal of the driving licence (Council of the European Communities, 1991; Dobbs, 2005; The Eyesight Working Group, 2005; Austroads, 2006; Commission of the European Communities, 2009; SafetyNet, 2009).

Thanks to the contribution of technological development in diagnosis and treatment of diseases like epilepsy and diabetes (Second European Working Group on Diabetes and Driving, an advisory board to the Driving Licence Committee of the European Union, 2006; Second European Working Group on Epilepsy and Driving, an advisory board to the Driving Licence Committee of the European Union, 2005), some eligibility criteria in fitness to drive are self-evident while others are to some extent arbitrary. Alongside the spreading of stricter guidelines and law on fitness to drive, a lean attitude in its assessment is required (Thomas and Hughes, 2009).

Therefore, in making a licensing decision, the authorities are asked to seek input regarding a person's medical fitness to drive, either directly from the driver and/or from a medical practitioner or other health professionals (such as general practitioners, specialists, optometrists, psychologists, occupational therapists and physiotherapists). In several countries the authority can be helped by health professionals, police or members of the public.

Nevertheless health professionals are responsible for the assessment of the person's medical fitness to drive using relevant medical standards, advising the person regarding the impact of the medical conditions on the ability to drive and recommending restrictions and ongoing monitoring (Austroads, 2006).

Assessing people's ability to drive has become a public health concern in most industrialized countries. Nationwide, guidelines suggest medical examinations and licence periodic review according to each single clinical condition (Dobbs, 2005; Canadian Medical Association, 2006; Austroads, 2006). Because of the complex nature of physical and mental impairments and their relationship to safe driving, it would be strongly recommended that a medical screening process for each condition ought to be detailed, shared and established in all countries (Molnar et al., 2007).

Important considerations in issuing a licence are: a thorough applicant screening process which may include a formal medical review, vision testing, and knowledge and skill examinations, including a road test.

Conventional medical examination for licence renewal is known to be of limited value in assessing the whole "on the road" ability and family members may not be good judges of patients' driving skills (Frittelli et al., 2009).

It is quite difficult to look for a cause and effect role of medical conditions on road traffic accidents, and the on- or off-road driving ability assessment appear to be a useful proxy.

By reviewing the scientific literature dealing with medical conditions and driving, we found the lack of systematic reviews on the relationship between screening tests and road safety in acute and chronic diseases (Marino et al., 2010). The Mini Mental State Examination (MMSE), neuropsychological tests and cognitive tests, for example, have been widely investigated as potential predictors of safe driving but there is conflicting evidence on their suitability (Lincoln et al., 2006).

Scientific literature mostly refers to secondary outcomes in assessing the screening test role and focuses its attention on the fitness to drive evaluation among drivers with disabilities.

Thus, our review aims at identifying and summarizing the relationship between neuropsychological and clinical screening test and fitness to drive among people with chronic conditions – thus including chronic conditions deriving from acute events.

Specifically, we seek to provide a snapshot on evidence-based instruments valid and reliable for health professionals (i.e. those physician and other health professionals who statutory have to assess fitness to drive in subjects with acute and chronic diseases in order to release/renew the driving licence according to each national normative), as it is of primary importance to find a way to differentiate safe from unsafe drivers.

2. Materials and methods

2.1. Searching

We conducted a systematic literature search for English-language articles published to 2010, using Pubmed (1966 to April 2010); Embase (1988 to April 2010); CINAHL pre – CHINAL (no restrictions, n.r.); Cochrane Database of Systematic Reviews (n.r.); Database of Abstracts of Reviews of Effects (n.r.) and Cochrane Central Register of Controlled Trials CENTRAL (n.r.). As well the following no-biomedical databases were reviewed: TRIS – Transport Research Information Service (n.r.); PsycINFO (n.r.); C2-SPECTR – Campbell Collaboration Social, Psychological, Educational and Criminological Trias Register; ERIC – Educational Resources Information Center (n.r.); EPPI CENTRE (n.r.), NHS Economic Evaluation Database (n.r.) and Econlit (n.r.).

Each search engine was investigated using a combination of database specific subject headings (starting from the following Mesh Terms: Motor Vehicles, Automobile Driving, Accidents – Traffic, Automobiles, Physical Examination, Neuropsychological Tests, Disability Evaluation, Mass Screening, Predictive Value of Tests, Diagnostic Techniques and Procedures, Task Performance and Analysis, Trauma – Nervous System, Myasthenia Gravis, Epilepsy, Risk Factors, Psychomotor Performance, Psychomotor Disorders, Physical Fitness, Parkinson Disease, Nervous System Diseases, Mental Disorders, Diabetes Mellitus, Delirium–Dementia–Amnesic–Cognitive Disorders, Cardiovascular Diseases, Chronic Disease, Alzheimer Disease, Vision–Ocular, Vision Tests, Vision Screening, Diabetic Nephropathies, Kidney Diseases, Hearing Disorders, Hearing Tests, Hearing, Hearing Impaired Persons, Certification, Licensure, Automobile Driver Examination–NOT Aged, 80 and over, Adolescent) and free text-words. The Boolean search algorithm used to search Medline was adapted for other databases (Additional file 1).

2.2. Inclusion criteria

Articles meeting the following criteria were eligible for review the relationship between screening tests and fitness-to-drive among people affected by physical and mental chronic conditions:

- types of studies*: randomised controlled trial; controlled before and after study/cohort analytic; interrupted time series;
- types of participants*: anyone aged 18+ years with a previous diagnosis of one or more of the following diseases, according to the conditions for issuing driving licences stated in the Directive 91/439/EEC (Council of the European Communities, 1991; Commission of the European Communities, 2009): Alzheimer and other dementias, Cardiovascular Diseases, Diabetes Mellitus, Mental Disorders, Parkinson Disease, Myasthenia Gravis, Renal disorders, Sleep Apnea Syndrome, Other Nervous system diseases including Epilepsy, Hearing Disorders, Vision Disorders, Traumatic Brain Injuries, Hepatic Encephalopathy and

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