# Fitness to drive assessment in drivers with neurological disorders at Medical Driver Test Centres

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*FITNESS TO DRIVE ASSESSMENT IN DRIVERS WITH NEUROLOGICAL DISORDERS AT THE MEDICAL DRIVER TEST CENTRES*

***Summary.*** Introduction. *Drivers with a neurological pathology have a greater risk of involvement in traffic accidents than healthy drivers.* Aim. *To evaluate the fitness to drive of drivers with a neurological or neuromuscular pathology.* Subjects and methods. *5,234 drivers attending two Medical Driver Test Centres with the aim of carrying out a medical-psychological examination to obtain or renew their driving license were included in the study. Information was obtained concerning socio-demographic aspects, driving habits, the referred pathology and consumption of medicaments and alcohol.* Results. *1.4% of the drivers presented a neuromuscular or neurological pathology. The most frequent were muscular disorders of a neurological origin (32.5%), a history of cerebrovascular accidents (27%) and epilepsy (24.3%). 21.6% of the drivers were considered 'fit', 77.1% were 'fit with restrictions', and only 1.3% were considered 'unfit' to drive.* Conclusions. *The great majority of drivers (98.7%) with a neurological pathology are considered 'fit' or 'fit with restrictions' to drive. Even though only a small percentage of divers with neurological pathologies are considered 'unfit' to drive, given their increased risk of involvement in traffic accidents, an early, individual evaluation of these patients' fitness to drive, taking into account the associated pathology, prescribed medication, consumption of alcohol and age, would seem necessary. [REV NEUROL 2007; 45: 526-31]*

***Key words.*** *Automobile driver examination. Fitness to drive. Neurological disorders. Traffic accidents.*

## INTRODUCTION

Several studies have shown that drivers with certain neurological pathologies have a greater risk of being involved in a traffic accident than do healthy drivers [1-3]. In a recent meta-analysis [4], drivers with neurological pathologies (categories mentioned in the European Directive CD 91/439/EEC) presented a relative risk of 1.75 (95% CI: 1.81-1.89) of being involved in a traffic accident with respect to healthy controls. It is because of this greater risk that developed countries have passed laws imposing certain restrictions on obtaining or renewing a driving licence for those drivers who have certain neurological pathologies, as well as other medical conditions [5-7]. Within the EU, the European Directive CD 91/439/EEC establishes the minimum requirements when assessing fitness to drive, while there are still significant differences from one country to another [5].

Spain is the only country in the EU which, for several decades, has carried out mandatory assessments of fitness to drive for all drivers of motor vehicles. The said assessment is carried out in specific centres, the Medical Driver Test Centres (CRC). There is great controversy as to the cost-profits of the medical assessment of drivers and, in general, several studies have not been able to provide evidence for any benefits from this assessment [8-10]. In this country, the assessment of fitness to drive in patients with neurological pathologies has been of increasing interest recently [11-14].

The current regulations are set out in the Royal Decree 1598/2004 [15]. Paragraph 9 of this decree sets out the aspects with respect to the assessment of fitness to drive in those persons with neurological or neuromuscular pathologies (Table I).

More than two million drivers are assessed every year in Spain. This information, however, is not stored in any database, so very little information is available concerning driver pathologies and the results of the fitness to drive assessment.

The aim of this study is to analyse the prevalence of neurological and neuromuscular illnesses among drivers attending Medical Driver Test Centres to assess their fitness to drive, as well as the result of the said assessment.

## PATIENTS AND METHODS

The target population of the study consists of all the drivers who attended two Medical Driver Test Centres (Centro de Reconocimiento de Conductores del Colegio Oficial de Médicos de Navarra y el Gabinete Psicotécnico de Huesca) to obtain or renew their driving licence. The study was approved by the Ethical Commission for Clinical Research of the Faculty of Medicine of the University of Valladolid. All the drivers signed consent forms before participating in the study. A detailed description of the study has already been published [16]. The data of the said study have been analysed again in the context of the Thematic Cooperative Research Network, Addictive Disorders Network (Red Temática de Investigación Cooperativa, Red de Trastornos Adictivos).

5,234 drivers were included in the study, 3,741 men (71.5%) and 1,493 women (28.5%). Ages ranged from 14 years old for the youngest and 98 years old for the eldest. The mean age was 44.05 ± 16.41 (mean ± DE), 46.1 ± 17.1 for men and 39.4 ± 13.6 for women. The distribution by age range was as follows: < 25 years: 616; 25-34 years: 107; 35-44 years: 1,013; 45-54 years: 1,126; 55-64 years: 642; 65-74 years: 533; and > 74 years: 197. The percentage of drivers who did not wish to participate in the study was 2%.

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**Table I.** Assessment (RD 1598/2004) of neurological and muscular illnesses, paragraph 9.

| | Fitness criteria for obtaining or renewing ordinary driving licence (group 1) [a] | Fitness criteria for obtaining or renewing professional driving licence (group 2) [b] |
|---|---|---|
| Neurological disorders: illnesses of the central nervous system and the peripheral nervous system | The loss or serious reduction of sensorial motor functions or of coordination are not allowed; syncopal episodes, shaking with great oscillations, spasms of the head, extremities or trunk or other trembling that can affect driving ability | |
| Epilepsies and other convulsive crises | Convulsive crises that may include loss of consciousness are not allowed in the previous 12 months<br>Crises during sleep: check that over 12 months there is only this symptomatology<br>Myoclonic jerking that could affect driving: 3 months without a crisis<br>Secondary or unconnected single convulsive disorder. 6 months without reapparition<br>(In all cases the report should state absence of pharmacological interference and the crisis free period) | There should have been no crises or treatment over the previous 5 years<br>Crisis during sleep: if during 12 months there have only been these crises<br>Myoclonic jerking that could affect driving<br>(In all cases the report should state absence of pharmacological interference and the crisis free period) |
| Balance disorders | Vertigo, instability, dizziness or permanent progressive or intense stumbling, whether otological or not, are not allowed | *Idem* |
| Muscular disorders | Are not allowed if they produce motor deficiency | *Idem* |
| Recurrent ischemic accidents | TIA (transitory ischemic attacks) are not allowed until 6 months have passed without neurological symptoms, including a report by the specialist<br>Recurrent TIA are not allowed | *Idem* |

[a] Group 1: includes those who are holders of a driving licence applying for renewal or those who have applied for a new licence of types A1, A, B or B + E; [b] Group 2 (professionals): includes those who are holders of a driving licence applying for renewal or those who have applied for a new licence of types C1, C1 + E, C, C + E, D1, D1 + E, D or D + E.

Table I shows the diagnostic categories included in the Spanish legislation with respect to neurological and neuromuscular illnesses, the fitness criteria for drivers of motor vehicles (group 1) and professionals (group 2), as well as the possible adaptations, restrictions and limitations with respect to the said illnesses [15].

Following the individualised clinical assessment of each driver, the three professionals of the centre (doctor, ophtalmologist and psychologist) decide jointly on the final result: 'fit', 'fit with restrictions' (mechanical restriction – vehicle adapted to the limitation, restriction in the duration of the licence, restricted maximum speed) and 'not fit'. In the present study, the assessment has been analysed as 'fit', 'fit with restrictions' and 'not fit' with respect to the neurological or neuromuscular disorder suffered by the patient. The report points out the main cause, and where necessary, the secondary cause, that gave rise to the assessment result of 'not fit' or 'fit with restrictions'.

Every pathology referred to by the drivers was registered and coded according to the CIE-10. As for medicaments, we registered the medicament being consumed, the number of doses per day and the duration of the treatment, as well as the categorization of the medicaments for their effect on fitness to drive:

– *Category 1:* no or little effect on driving ability.
– *Category 2:* moderately affects driving ability.
– *Category 3:* seriously affects driving ability.

Only those medicaments consumed with chronic illnesses (over 1 month) were registered [17].

As for the consumption of alcohol, we registered the frequency of the said consumption (daily: drinks alcohol every day, or weekly: drinks alcohol at least once a week), the quantity of alcohol consumed, expressed in standard drink units (SDU) per week (1 SDU = 10 g alcohol) [18], and the level of consumption: low (men ≤ 21 SDU/week, women ≤ 14 SDU/week), moderate (men 22-50 SDU/week, women 15-35 SDU/week), high risk (men > 50 SDU/week, women > 35 SDU/week).

The statistical programme SPSS v. 14.0 has been used, as well as the chi square test and the *t*-test. Values of $p \leq 0,05$ were considered statistically significant.

## RESULTS

74 (1.4%) of the 5,234 drivers assessed, with a mean age ± standard deviation of 55.2 ± 17.6 years, had some kind of neurological or neuromuscular pathology included in the list of assessment illnesses concerning fitness to drive (Table II), it being more frequent among the men (1.2%) than among the women (0.2%; $\chi^2 = 4.420$; $p < 0.05$) and who were older (57.6 ± 17.4 years) than the women (43.9 ± 14.9 years; $t = 2.637$; $p < 0.01$). 66 were active drivers (89%) and 8 drivers (11%) had voluntarily stopped driving. The mean age (55.2 ± 17.6 years) of the drivers with a neurological pathology was higher than that of all the participants in the study (44.05 ± 16.41 years; $t = 5.795$; $p < 0.005$).

Of the 74 persons with neurological or neuromuscular pathologies (Table II), 16 (21.6%) were considered 'fit', 44 (59.5%) 'fit with restrictions due to neurological or neuromuscular causes', and one driver (1.3%) was considered 'not fit' due to the muscular disorder of a neurological nature that he suffered, and which was incompatible with driving a motor vehicle. 13 (17.6%) of the cases were considered 'fit with restrictions' although the restriction was not due to the neurological pathology (in one case, although the patient suffered from a slipped disk hernia L5-S1, the restriction was due to a hypoacusis of over 45%; in another case, although the patient was suffering from a diabetic polyneuropathy, the restriction was due to a heart transplant; in yet another case, the driver had suffered an ictus from which he had totally recovered and the restriction was due to a decrease in hearing ability of more than 50%. In the 10 remaining cases, although there was a neurological pathology, the restriction was due to sight deficiencies, where spectacles had to be worn).

The most frequent pathologies were the 'muscular disorders of a neurological origin' (32.4%), followed by 'cerebrovascular accident' (CVA) (27%), and 'epilepsy and convulsive crises' (24.3%).

Table II shows the results of the fitness to drive assessment for each of the various processes.

28 drivers (37.8%) with a neurological or neuromuscular pathology were over 65 years of age, 31 (41,8%) had other pathologies, 53 took medication, in 23 (31%) of which the medication had a warning about its effect on driving ability, 44.6% consumed alcohol (16.2% weekly and 28.4% daily) although all of them had a low risk consumption (< 21 SDU/week in men and

**Table II.** Neurological and muscular illnesses and the result of 'fit', 'not fit' and 'fit with restrictions' in the medical assessment of fitness to drive.

| | Fit | | Fit with restrictions | | Fit with restriction due to neurological cause | | No fit | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % |
| Neurological and muscular pathologies with respect to the total number of neurological and muscular illnesses [a] | 16 | 21.6 | 44 | 59.5 | 13 | 17.6 | 1 | 1.3 | 74 | 100 |
| Muscular disorders of a neurological origin | | | | | | | | | | |
| Slipped disk | 1 | 25 | | | 3 | 75 | | | 24 | 32.4 [a] |
| Shaking | 3 | 42.8 | 2 | 28.6 | 2 | 28.6 | | | | |
| Sensitive and/or motor polyneuropathy | 1 | 20 | 2 | 40 | 1 | 20 | 1 | 20 | | |
| Paraplegia | | | 6 | 100 | | | | | | |
| Sequelas from polio | | | 2 | 100 | | | | | | |
| Transitory cerebrovascular accident | 6 | 30 | 10 | 50 | 4 | 20 | | | 20 | 27 [a] |
| Epilepsies and convulsive crises | 1 | 5.5 | 16 | 89 | 1 | 5.5 | | | 18 | 24.3 [a] |
| Balance disorders | 4 | 57.1 | 2 | 28.6 | 1 | 14.3 | | | 7 | 9.5 [a] |
| Neurological illnesses (CNS and PNS) | | | | | | | | | | |
| Craneo-encephalic interventions or lesions | | | 1 | 50 | 1 | 50 | | | 5 | 6.8 [a] |
| Parkinson | | | 3 | 100 | | | | | | |

[a] Percentages calculated over the total number of persons with a neurological or muscular pathology (*n* = 74). CNS: central nervous system; PNS: peripheral nervous system.

< 14 SDU/week in women), all conditions which could cause a deterioration in their psychomotor performance or fitness to drive.

By way of example, the assessment of the 20 patients with a history of cerebrovascular accidents is shown in table III. 6 drivers (30%) were considered 'fit', since their transitory cerebrovascular accident had left no kind of sequela, the medication they were taking did not affect their ability to drive and, although 3 of them consumed alcohol on a daily basis and 2 two of them on a weekly basis, their consumption was low risk. 50% (10 drivers) were found 'fit with restrictions of a neurological origin', due to the secondary sequelas to the CVA. In addition, 6 of these drivers had associated pathologies, 3 had a decrease in psychomotor performance (pathological restriction), 5 were taking medicaments that could affect their fitness to drive, 1 of them consumed alcohol on a daily basis and another 2 on a weekly basis, their consumption being low risk. For 4 (20%) drivers, the main restriction applied was not due to neurological causes; in one case it was due to a hypoacusis > 50% and in another three cases it was due to sight deficiencies, where spectacles had to be worn. No driver with a history of CVA was considered 'not fit' to drive.

## DISCUSSION

1.4% of the drivers who attend Medical Driver Test Centres to obtain or renew their driving licence present some kind of neurological or neuromuscular pathology. A low prevalence of such disorders can be seen among Spanish drivers, noticeably lower than for the general population (17%) [19], although the fact that the driving population cannot be compared with the general population should be taken into account (there are fewer women with a driving licence, especially in the highest age groups). This may be due to the fact that an important percentage of drivers with these disorders (11% in our study) stop driving of their own accord [3,20] because of the limitations they entail. On the other hand, it is possible that some patients lie about their condition or keep it hidden in their own interests when being assessed for their fitness to drive [12,21].

While there are obviously methodological differences and differences in the regulations, a study carried out in Utah (USA) [22] found a prevalence of neurological pathologies of 7.1%, clearly higher than that of 1.4% found in this study. However, the proportion of drivers found to be 'not fit' was similar (1.1%) to that found by us (1.3%). A very small percentage of drivers with these pathologies, as compared to that found by us (4% vs 59.5%), were considered to be 'fit with restrictions'. 70% of the drivers who presented neurological pathologies suffered from epilepsy, 24.3% in the current study. The remaining patterns that include the different pathologies analyzed are difficult to compare with the pathologies assessed in our study. As has already been mentioned, there are significant differences in the regulations (criteria and systems for assessing fitness to drive) in the various different countries [1,2,5-7,21].

The assessment of fitness to drive in a patient with a neurological or neuromuscular pathology is not a conventional medical examination. The assessment should be individualized: as well as the possible limitation imposed by the neurological or neuromuscular illness, other aspects that can affect fitness to drive (such as age, the presence of other pathologies, psychomotor-psychological, auditory and visual assessment and the consumption of alcohol/medicaments) need to be considered [23]. To sum up, the aim is to determine whether or not, after taking into account all the aspects of the assessment, the anomalies present in the patient add up to a legal reason to refuse or restrict the issuing of a driving licence [11].

**Table III.** Evaluation according to pathology of the drivers who have suffered a transitory cerebrovascular accident.

| Sex, age, employment situation | Licence type [a], km driven/year | Medication (active ingredients) | Alcohol consumption (units/week) | Medical problems | Hearing assessment (audiometry) | Ophtalmological assessment | Psychological assessment | Final result of the assessment |
|---|---|---|---|---|---|---|---|---|
| Woman, 73, housewife | B, 2,000 | Clopidogrel | Weekly | CVA | Fit | Fit using eyeglasses | Fit | Fit using eyeglasses [b] |
| Woman, 41, housewife | B, does not drive | Acenocoumarol | No | CVA | Fit | Fit | Fit with restriction | Fit with neurological restriction |
| Man, 69, retired | B, 2,000 | Trifusal<br>Tamsulosin<br>Sertraline<br>Phenobarbital | No | CVA<br>Hypertension | Fit | Fit using eyeglasses | Fit | Fit with neurological restriction |
| Man, 73, retired | B, 5,000 | Lovastatin<br>Verapamil<br>Acetylsalicylic acid<br>Atenolol | Daily 14 | CVA<br>Hypertension<br>Hyperlipemia | Fit with restrictions (hearing head) | Fit using eyeglasses | Fit | Fit with hearing restriction [b] |
| Man, 78, retired | B, 5,000 | Ticlopidine<br>Omeprazole | Daily 7 | CVA | Fit with restrictions (hearing head) | Fit using eyeglasses | Fit | Fit with neurological restriction |
| Man, 72, retired | B, 18,000 | Pravastatin<br>Acetylsalicylic acid | Weekly 4 | CVA<br>Hypertension<br>Hyperlipemia | Fit | Fit | Fit | Fit |
| Man, 76, retired | B, 5,000 | Acenocoumarol | Daily 7 | CVA<br>Arrhythmia | Fit | Fit using eyeglasses | Fit | Fit using eyeglasses [b] |
| Man, 84, active | B, 5,000 | Trifusal | No | CVA | Fit | Fit | Fit | Fit |
| Man, 54, active | B, 3,000 | Acetylsalicylic acid | Daily 14 | CVA | Fit | Fit | Fit | Fit |
| Man, 83, retired | B, 7,000 | Bisoprolol<br>Nimodipine<br>Clopidogrel<br>Finasteride<br>Lorazepam | No | CVA<br>Coronariopathy<br>Anxiety | Fit | Fit | Fit | Fit with neurological restriction |
| Man, 71, retired | B, 20,000 | Nifedipine<br>Acetylsalicylic acid<br>Fluoxetine<br>Ticlopidine | Weekly 2 | CVA | Fit | Fit using eyeglasses | Fit | Fit with neurological restriction |
| Man, 73, retired | B, 3,000 | Trifusal<br>Nimodipine | Daily 4 | CVA | Fit | Fit using eyeglasses | Fit | Fit using eyeglasses [b] |
| Man, 78, retired | B, 3,000 | Zolpidem<br>Streptokinase<br>Pentoxyphiline | No | CVA<br>Hypertension | Fit | Fit using eyeglasses | Fit | Fit with neurological restriction |
| Man, 70, retired | B, 3,000 | Budesonide<br>Salbutamol | Weekly 4 | CVA<br>COPD | Fit | Fit | Fit with restrictions | Fit with neurological restriction |
| Woman, 65, retired | B, does not drive | Acetylsalicylic acid<br>Dobesilate of calcium | Daily 7 | CVA<br>Scoliosis | Fit | Fit | Fit | Fit |
| Man, 68, retired | B, 18,000 | Doxazosin<br>Telmisartan<br>Sertraline<br>Lorazepam | No | CVA<br>Hypertension | Fit | Fit using eyeglasses | Fit with restrictions | Fit with neurological restriction |
| Man, 60, active | B, 50,000 | No | Weekly 3 | CVA | Fit | Fit | Fit | Fit |
| Man, 63, retired | B, 5,000 | Trifusal<br>Amlodipine | Daily 14 | CVA<br>Hypertension | Fit | Fit | Fit | Fit |

**Table III.** Evaluation according to pathology of the drivers who have suffered a transitory cerebrovascular accident *(cont.).*

| Sex, age, employment situation | Licence type [a], km driven/year | Medication (active ingredients) | Alcohol consumption (units/week) | Medical problems | Hearing assessment (audiometry) | Ophtalmological assessment | Psychological assessment | Final result of the assessment |
|---|---|---|---|---|---|---|---|---|
| Man, 74, retired | B, 3,000 | Diclophenaco Salbutamol | No | CVA Arthrosis Respiratory insufficiency | Fit with restrictions (hearing aid) | Fit | Fit | Fit with neurological restriction |
| Man, 60, active | B, 10,000 | Ticlopidine Simvastatin | No | CVA | Fit | Fit | Fit | Fit with neurological restriction |

[a] B: non professional licence, C: professional licence. [b] Drivers 'fit with restrictions' whose restriction, in spite of having a neurological pathology, was not due to the said pathology. CVA: cerebrovascular accident; COPD: chronic obstructive pulmonary disease.

Nevertheless, the importance of medical advice when considering fitness to drive in patients with neurological pathologies must be stressed, since, as has already been pointed out, many patients begin to drive after suffering a neurological pathology without submitting to an assessment of their fitness to drive [13,24]. In this sense, the Traffic Committee of the Spanish Neurological Society, in collaboration with the traffic authorities (DGT) [25], has issued a series of recommendations that aim to reduce the risk of traffic accidents among drivers with neurological pathologies. These recommendations refer to the need for greater knowledge on the patient's part concerning the risk of accident due to his/her illness and the medication, as well as the factors that can have repercussions for both the illness itself and fitness to drive (alcohol, sleep habits), and also the need to adapt his/her driving habits to the evolution of the illness and the responsibility to inform the Medical Driving Test Centre of the said illness at the time of application.

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*EVALUACIÓN EN LOS CENTROS DE RECONOCIMIENTO DE CONDUCTORES DE LOS PACIENTES CON PATOLOGÍA NEUROLÓGICA Y NEUROMUSCULAR*

***Resumen.*** Introducción. *Los conductores con patología neurológica presentan un mayor riesgo de implicación en colisiones de tráfico que los conductores sanos.* Objetivo. *Valorar la aptitud para conducir de los conductores con patología neurológica o neuromuscular.* Sujetos y métodos. *Se incluyó en el estudio a 5.234 conductores que acudieron a dos centros de reconocimiento de conductores, con el fin de realizar el reconocimiento médico-psicológico para obtener o renovar el permiso de conducir. Se recogió información sobre aspectos sociodemográficos, pautas de conducción, patología referida, consumo de medicamentos y consumo de alcohol.* Resultados. *El 1,4% de los conductores presentaba patología neurológica o neuromuscular. Los procesos más frecuentes fueron los trastornos musculares de origen neurológico (32,5%), antecedentes de accidente cerebrovascular (27%) y epilepsia (24,3%). Se valoró al 21,6% de los conductores como 'apto', al 77,1% como 'apto con restricciones', y al 1,3% como 'no apto' para conducir.* Conclusiones. *Se valoró a una gran parte de los conductores (98,7%) con patología neurológica como 'aptos' o 'aptos con restricciones' para conducir. Aunque sólo un pequeño porcentaje de conductores con patologías neurológicas está incapacitado para conducir, dado el incremento de riesgo de estar implicados en accidentes, es necesaria la valoración precoz e individualizada de la aptitud para conducir en estos pacientes, teniendo en cuenta la patología asociada, medicación prescrita, consumo de alcohol y edad. [REV NEUROL 2007; 45: 526-31]*

***Palabras clave.*** *Accidentes de tráfico. Aptitud para conducir. Examen para conducir automóviles. Patologías neurológicas.*