

## Monography

## Disability related to road traffic crashes among adults in Spain



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## ABSTRACT

**Background:** Road traffic accidents cause substantial morbidity and disease burden; few studies have examined their impact on disability.

**Objective:** To estimate the magnitude and distribution of disability due to road traffic accidents according to socio-demographic variables, and its main socioeconomic and health determinants.

**Methods:** A cross-sectional study was conducted in community-dwelling participants in the “2008 Spanish National Disability Survey”, a representative sample of 91,846 households with 20,425 disabled persons older than 15 years; 443 had disability due to road traffic accidents.

**Results:** The prevalence was 2.1 per 1000 inhabitants (95% CI: 1.8–2.3), with no differences by sex. Risk was highest among persons aged 31 to 64 years, and onset of disability showed a sharp inflection point at age 16 years in both sexes. Odds ratios (ORs) were higher (OR = 1.3; 95% CI: 1.1–1.7) for participants with secondary education than for those with the lowest educational levels and were lower (OR: 0.5; 95% CI: 0.3–0.8) for participants with the highest household income levels than for those with lowest. Only 24% of disabled participants were gainfully employed. As compared to other sources of disability, traffic crashes caused greater disability in terms of mobility (OR = 3.1;  $p < 0.001$ ), a greater need for health/social services (OR = 1.5;  $p = 0.003$ ), and more problems with private transportation (OR = 1.6;  $p < 0.001$ ), moving around outside the home (OR = 1.6;  $p < 0.001$ ) and changes in economic activity (OR = 2.4;  $p < 0.001$ ).

**Conclusions:** The prevalence of disability due to road traffic accidents in Spain is lower than in other developed countries, with middle-aged and socio-economically underprivileged persons being the most affected. Disability due to road traffic accidents is related to a greater demand for social/health care support, problems of accessibility/commuting, and major changes in economic activity.

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## Discapacidad por accidentes de tráfico en la población adulta española

## RESUMEN

## Palabras clave:

Evaluación de la Discapacidad

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Lesiones externas

Inequidades

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**Antecedentes:** Los accidentes de tráfico causan importante morbilidad y carga de enfermedad; su impacto sobre la discapacidad ha sido poco estudiado.

**Objetivo:** Estimar la magnitud y distribución de la discapacidad por accidentes de tráfico según variables socio-demográficas, y sus principales condicionantes socio-sanitarios y económicos.

**Métodos:** Estudio transversal en participantes de la Encuesta Nacional de Discapacidad, Autonomía Personal y Situaciones de Dependencia 2008; muestra representativa de 91.846 hogares con 20,425 discapacitados mayores de 15 años, 443 causados por accidentes de tráfico.

**Resultados:** La prevalencia fue de 2,1 por 1000 (IC 95%: 1,8–2,3), sin diferencias por sexo y mayor riesgo entre 31–64 años. La discapacidad tuvo inicio abrupto a los 16 años (ambos sexos). Aquellos con educación secundaria tuvieron un mayor odds ratio OR (OR = 1,3; IC 95%: 1,1–1,7) que aquellos con menor nivel educativo; los discapacitados con mayores ingresos tuvieron menor OR (OR = 0,5; IC 95%: 0,3–0,8) que aquellos con ingresos más bajos. Sólo un 24% tenían empleo remunerado. Comparado con otras causas de discapacidad, los accidente de tráfico generaron mayor discapacidad en movilidad (OR = 3,1;  $p < 0,001$ )

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y necesidad de asistencia socio-sanitaria (OR = 1,5; p = 0,003); mayores problemas con el transporte privado (OR = 1,6; p < 0,001), los desplazamientos fuera de casa (OR = 1,6; p < 0,001) y cambios en la actividad económica (OR = 2,4; p < 0,001).

**Conclusiones:** La prevalencia en España es baja comparada con otros países desarrollados. La población de mediana edad y con desventajas socio-económicas fue la más afectada. La discapacidad por tráfico se relaciona con mayor demanda de servicios socio-sanitarios, problemas de accesibilidad y movilidad e importantes cambios en la actividad económica.

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## Introduction

Injuries caused by road traffic crashes (RTCs) have a major impact on morbidity, mortality and premature disability. According to the World Health Organisation (WHO), every year there are over 1.2 million deaths due to this cause around the world, 20 to 50 million persons sustain injuries, and more than 5 million remain disabled for life.<sup>1</sup> RTCs cause disability in the short and long term, are the 9<sup>th</sup> leading cause in the world of disability-adjusted life years (DALYs) and generate 41.2 million years of healthy life lost, thus accounting for 2.7% of the total worldwide.<sup>2–5</sup> It is estimated that there are 3.8 million disabled persons in Spain. Accidents are the 3<sup>rd</sup> leading cause of disability and account for 9% of all disability; within this category, RTCs rank second after occupational accidents.<sup>6</sup>

Despite the appreciable reduction in traffic accident figures observed in this country from 2000 onwards,<sup>7</sup> the resulting injuries continue generating a substantial disease burden, with a great impact on the country's social and economic spheres. RTCs generate premature mortality,<sup>8</sup> continue to be the leading specific cause of death in the 15–34 year age group, and are the leading (in men) and 2<sup>nd</sup> leading cause (in women) of years of potential life lost.<sup>9</sup>

On investigating the effects on RTC-injury victims, analysis of disability can provide a complementary view of this event and furnish the necessary information for the prevention and control of RTCs, and so minimise the risk of premature death, disability and *sequelae*. Road traffic disability (RTD) is an important indicator of the severity of such accidents, and allows for assessment of related temporary or permanent disability, loss of autonomy, individual development disorders, family involvement and the ensuing social burden.<sup>10</sup>

The aim of this study was thus to provide a first-ever estimate of the magnitude and distribution of disability caused by RTCs in Spain, and to describe the RTC-disabled population by reference to basic socio-demographic variables, as well as the types of RTC-related disability and their main socio-economic and health profiles.

## Methods

### Study design and population

A cross-sectional study was conducted among community-dwelling participants of the “2008 National survey of disability, personal autonomy and situations of dependency” (EDAD2008). The survey covered all regions of Spain from November 2007 to February 2008, targeting all persons residing in main family dwellings.<sup>11</sup>

The EDAD2008 was based on a two-stage, stratified sampling design, with the first-stage units being census sections and the second-stage units being main family dwellings. A sample size of 96,075 households was established. Response was obtained from 91,846 households (overall response rate of 97%),<sup>12</sup> yielding data

on 213 626 subjects, including 20,425 disabled persons over the age of 15 years, 443 of whom had disability due to traffic crashes. The data-collection method used was the personal interview.<sup>11</sup>

### Study variables

The EDAD2008 partly follows the conceptual framework of the International Classification of Functioning, Disability and Health (ICF),<sup>13</sup> according to which disability is defined as, “a set of limitations on activities of daily living and participation restrictions (handicaps), which have lasted or are envisaged to last for more than one year and have their origin in some impairment, even though they may have been overcome with the use of external technical aids or with the aid or supervision of another person.” For study purposes, RTD was defined as, “any type disability caused by a road traffic accident”, and analysed using the following independent variables: sex; age (four groups); educational level (no formal education/primary; secondary/intermediate; higher/university); marital status (single; married; widowed; divorced/separated); nationality (Spanish; foreign/dual); occupation (employed; unemployed; receiving any type of pension; unfit for work; other non-remunerated activity); net monthly household income (<€500; €500–<€1,500; €1,500–<€3,000; >=€3,000); type of disability (vision; hearing; communication; learning, application of knowledge and performance of tasks; mobility; self-care; domestic life; interpersonal interactions/relationships); age at disability onset (exact age); health and social conditions (health status; need of consultation/health/social services; type of help received; financial benefit or compensation; problems with transport and commuting); economic conditions (primary household earner; change in economic activity; reason for leaving work; expenditure in the preceding year; and main items of expenditure).

### Statistical analysis

We calculated the crude prevalence and its 95% confidence interval (CI), using the total number of persons surveyed over the age of 15 years (n = 213 626) as the reference population. The distribution according to socio-demographic variables was summarised with odds ratios (ORs) obtained from logistic regression models, controlling for all socio-demographic variables simultaneously. We calculated the proportion of the respective types of disability and the main health, social and economic conditions in two groups, i.e., RTD and other causes of disability (OCD). Differences were adjusted for sex, age group and educational level using logistic regression, with statistical significance being set at  $p < 0.05$ . The complex sampling design was considered during analysis, which accounts for weighting, clustering, and stratification, by using the “Survey Data” module of the Stata v.12.0 for Windows computer software programme (StataCorp. 2011. *Stata Statistical Software: Release 12*. College Station, TX: StataCorp LP). Standard errors were computed by using the linearized variance estimator based on a first-order Taylor series. First-order interactions were evaluated between sex and others sociodemographic variables.

**Table 1**  
Disability by road traffic crashes according to socio-demographic variables among individuals aged 16 and over. Spain, 2008.

	n	Prevalence/1000 (95% CI)	Adjusted OR <sup>a</sup> (95% CI)
Total	443	2.1 (1.8 - 2.3)	
Sex			
Men	239	2.3 (2.0 - 2.7)	Ref
Women	204	1.9 (1.6 - 2.2)	0.9 (0.8 - 1.2)
Age groups			
16 to 30 ages	44	0.8 (0.6 - 1.3)	Ref
31 to 45 ages	129	2.0 (1.6 - 2.6)	2.8 (1.7 - 4.6)
46 to 64 ages	167	2.9 (2.4 - 3.4)	2.1 (1.2 - 3.7)
≥ 65 ages	103	2.5 (2.0 - 3.0)	0.6 (0.3 - 1.1)
Educational level			
Not study/primary study	230	2.6 (2.3 - 3.0)	Ref
Sec- ondary/bachelor/Intermediate vocational	166	2.1 (1.7 - 2.6)	1.3 (1.1 - 1.7)
Higher vocational/University	47	1.0 (0.7 - 1.4)	0.8 (0.5 - 1.1)
Marital status			
Single	144	2.0 (1.7 - 2.5)	Ref
Married	214	1.8 (1.5 - 2.2)	0.6 (0.5 - 0.8)
Widowed	46	2.8 (2.1 - 3.8)	0.5 (0.3 - 0.8)
Divorced/Separated	39	4.3 (3.1 - 6.0)	1.1 (0.7 - 1.7)
Nationality			
Spanish	419	2.2 (1.9 - 2.4)	Ref
Foreign/Dual nationality	24	1.3 (0.5 - 2.9)	0.8 (0.4 - 1.9)
Occupation in preceding week			
Gainfully employed	106	0.9 (0.7 - 1.2)	Ref
Unemployed	30	2.2 (1.4 - 3.4)	2.0 (1.1 - 3.5)
Receiving pensions by retirement, permanently disability and others	240	5.5 (4.7 - 6.3)	12.7 (8.6 - 18.7)
Unfit for work (without any type of pension)	22	19.8 (12.5 - 31.2)	19.5 (11.3 - 33.7)
Other non-remunerated activities	45	1.1 (0.7 - 1.5)	1.5 (1.0 - 2.4)
Net monthly household income			
Under €500	41	5.6 (4.0 - 7.9)	Ref
€500 to <€1,500	237	2.9 (2.4 - 3.4)	0.7 (0.5 - 1.1)
€1,500 to <€3,000	114	1.4 (1.2 - 1.7)	0.5 (0.3 - 0.8)
≥ €3,001	26	1.3 (0.8 - 2.2)	0.6 (0.3 - 1.1)
No answer/No information	25	1.0 (0.6 - 1.7)	0.3 (0.2 - 0.7)

<sup>a</sup> : Odds ratios simultaneously adjusted by all variables of the table

## Results

In 2008, the prevalence of RTD in Spain was 2.1 per 1000 inhabitants; injuries were the fourth cause of disability and within these, traffic accidents ranked second.

Table 1 shows the distribution of RTD by socio-demographic variables. In comparison with persons aged 16 to 30 years, the odds ratio (OR) of having RTD was higher in the 31-64 year age group and particularly among those aged 31 to 45 years, with an OR of 2.8 (95% CI: 1.7-4.6). There were no statistically significant differences by sex or nationality. Subjects with a secondary education had a higher OR than did those with a primary education or lower (OR = 1.3; 95% CI: 1.1-1.7); and married (OR = 0.6; 95% CI: 0.5-0.8) and widowed persons (OR = 0.5; 95% CI: 0.3-0.8) had a significantly lower OR than did singletons. Nevertheless, there was an interaction between sex and marital status statistically significant: the comparison of married men versus single showed an OR of 0.4 (CI: 0.2-0.5) while women had an OR of 1.7 (1.4-2.8). A breakdown by occupation showed that persons with RTD were more likely to be "unfit for work, without any type of allowance" (OR = 19.5; 95% CI: 11.3-33.7) or "receiving different types of pensions" (OR = 12.7; 95% CI: 8.6-18.7); only 24% were gainfully employed. Persons with household incomes of

€1,500 to < €3,000 per month had an OR = 0.5 (95% CI: 0.3-0.8) as compared to those with monthly family incomes below €500. Apart from sex and marital status we did not find other statistically significant interactions between sex and sociodemographic variables.

Figure 1 depicts age at disability onset. Seven out of ten persons affected by RTD reported onset of disability before the age of 45 years. The disability onset curve showed an inflection point at age 16 years in both sexes, with onset of disability occurring before the age of 28 years in half of all men and before the age of 40 years in women. This difference of approximately 10 years in RTD onset between men and women remained in evidence up to age 65 years.

Table 2 describes the type of disability. Mobility, domestic life and self-care were the most frequent types of disability in all disabled persons, and were significantly higher in the case of RTD regarding to other causes of disability (mobility OR = 3.1;  $p < 0.001$ ; domestic life OR = 1.8;  $p < 0.001$ ; self-care OR = 1.3;  $p = 0.046$ ). Hearing ( $p < 0.001$ ), communication ( $p < 0.040$ ), learning ( $p < 0.005$ ) and interaction/interpersonal relationship ( $p < 0.008$ ) disability, were meaningfully lower in the RTD-persons.

Table 3 shows health and social conditions with respect to disability. Although 68.8% of RTD-sufferers perceived their health status as fair or poor, this percentage was not significant in comparison with the OCD category. Subjects with RTD had a greater need of health/social services (OR = 1.5;  $p = 0.003$ ), required more technical aids (OR = 1.4;  $p = 0.014$ ), and experienced more problems with private transportation (OR = 1.6;  $p < 0.001$ ) and moving around outside the home (OR = 1.6;  $p < 0.001$ ).

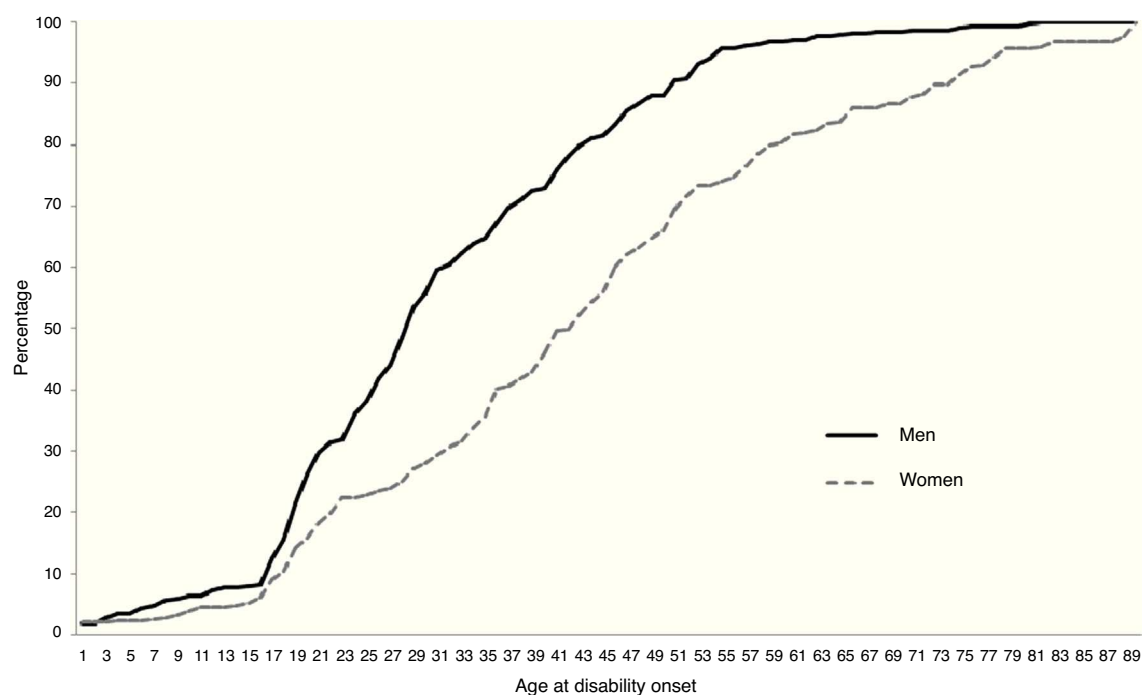
In terms of economic conditions (Table 4), close on 50% of all disabled persons were the primary household earners, with no difference between the RTD and OCD categories. RTD caused major changes in economic activity due to the onset or worsening of disability among persons who were gainfully employed (OR = 2.4;  $p < 0.001$ ). Health reasons were the most frequent cause for leaving work; disability-related early retirement was higher among persons in the RTD than among those in the OCD category, but this difference was not significant. No differences were observed in terms of disability-related expenditure and the main items to which such expenditure was allocated.

## Discussion

In Spain, RTCs generate two disabled persons per 1,000 population over the age of 15 years. This prevalence rate is lower when compared to data published by other developed countries<sup>10,14-16</sup> but higher in relation to recent Chinese studies,<sup>17,18</sup> despite the fact that such information displays important differences in methods, data-sources and type of population analysed. This lower prevalence could be related to the decrease in RTCs with victims, and the ensuing decrease in serious injuries (-43%) in the period 1998-2007.<sup>7,9</sup>

Although statistics and previously published studies agree on the fact that the greatest number of road accident-related deaths, injuries and disabilities affect young/middle-aged men,<sup>1,3,5,9,17-19</sup> the profile of the RTD-sufferer in Spain coincides only in terms of age because our study failed to find any significant differences by sex.

As compared to the general population, RTD-sufferers in Spain have a low socio-economic status (worse educational level; lower proportion engaged in gainful employment; high percentage receiving permanent disability retirement or other pensions, unfit for work, and living in the lowest-income households).<sup>6</sup> This situation makes them a vulnerable population, with important disadvantages in social aspects: indeed, the socio-economic



**Figure 1.** Age at onset of disability caused by road traffic crashes among individuals aged 16 and over. Spain, 2008.. Cumulative percentage by sex.

**Table 2**  
Types of Disabilities caused by road traffic crashes and other causes among individuals aged 16 and over. Spain, 2008..

	Road traffic crashes n = 443 n (%)	Other causes of disability n = 20,425 n (%)	Adjusted OR <sup>a</sup>	p value
<i>Type of disabilities</i>				
Vision Disability	81 (18.3)	5,370 (26.3)	0.8	0.087
Hearing Disability	67 (15.1)	5,856 (28.7)	0.6	<0.001
Communication Disability	60 (13.6)	3,824 (18.7)	0.7	0.040
Learning Disability	45 (10.1)	3,258 (16.0)	0.6	0.005
Mobility Disability	362 (81.7)	13,803 (67.6)	3.1	<0.001
Self-Care Disability	193 (43.5)	9,937 (48.7)	1.3	0.046
Domestic Life Disability	267 (60.2)	11,454 (56.1)	1.8	<0.001
Interaction and interpersonal relationship Disability	58 (13.1)	3,305 (16.2)	0.6	0.008

<sup>a</sup> : Odds ratios of road traffic disability regarding to other causes of disability simultaneously adjusted by sex, age and educational level

**Table 3**  
Health and social conditions of disability caused by road traffic crashes and others causes among individuals aged 16 and over. Spain, 2008..

	Road traffic crashes n = 443 n (%)	Other causes of disability n = 20,425 n (%)	Adjusted OR <sup>a</sup>	p value
<i>Perceived health status<sup>b</sup></i>				
Very good/Good	138 (31.2)	5,170 (25.4)	Ref	—
Fair/Poor/Very poor	305 (68.8)	15,200 (74.6)	1.2	0.156
<i>Last month consultation by health problems or illness<sup>b</sup></i>	230 (52.4)	9,302 (50.0)	1.1	0.251
<i>Need of health/social services and medical consult in the last year</i>	290 (65.4)	11,834 (57.9)	1.5	0.003
<i>Type of helps received by disability</i>				
Technical aids	159 (35.8)	7,567 (37.1)	1.4	0.014
Personal assistance	222 (50.1)	11,258 (55.1)	1.2	0.137
<i>Financial benefit or compensation last 12 months<sup>b</sup></i>	68 (15.4)	1,879 (9.2)	1.1	0.694
<i>Problems with the transport and commuting</i>				
Public transportation	103 (23.2)	4,598 (22.5)	1.1	0.533
Private transportation	141 (31.8)	6,622 (32.4)	1.6	<0.001
Problems for moving on the street	226 (51.1)	10,059 (49.3)	1.6	<0.001

<sup>a</sup> : Odds ratios of road traffic disability regarding to other causes of disability simultaneously adjusted by sex, age and educational level

<sup>b</sup> : Category "no answer" excluded

**Table 4**

Economic conditions of disability caused by road traffic crashes and others causes among individuals 16 years and older, Spain 2008.

	Road traffic crashes n = 443 n (%)	Other causes of disability n = 20,425 n (%)	Adjusted OR <sup>a</sup>	p value
Primary household earner: Disabled person	225 (50.8)	9,735 (47.7)	1.2	0.117
Change in economic activity due to onset or worsening of disability (age range 16–64 years)	191 (56.2)	2,603 (35.7)	2.4	<0.001
Reason for leaving work (age range 16–64 years) <sup>b</sup>				
Health reasons	97 (50.8)	1,304 (50.1)	Ref	–
Disability-related early retirement	46 (24.3)	458 (17.6)	1.4	0.142
Other reasons	48 (24.9)	841 (32.3)	0.8	0.202
Expenditure in preceding year per disability <sup>c</sup>				
None	285 (69.6)	13,129 (70.5)	Ref	–
Under €3,000	94 (23.0)	4,234 (22.7)	0.9	0.716
Over €3,000	30 (7.4)	1,274 (6.8)	1.1	0.623
Main items of expenditure in preceding year <sup>d</sup>				
Technical aids and personal care	54 (44.0)	2,545 (46.2)	1.2	0.472
Medications/medical, therapeutic or rehabilitation treatment	59 (47.3)	2,448 (44.5)	0.9	0.518
Other (adaptations, transport and commuting, etc.)	77 (61.9)	2,951 (53.6)	1.5	0.085

<sup>a</sup> : Odds ratios of road traffic disability regarding to other causes of disability simultaneously adjusted by sex, age and educational level.

<sup>b</sup> : Data among those with change in economic activity; category “no answer” excluded

<sup>c</sup> : Category “no answer” excluded

<sup>d</sup> : Data among those with expenditure the preceding year

inequalities in traffic injuries and fatalities have been reported by previous studies,<sup>4,17,18,20–23</sup> where the risk of road traffic injuries and fatalities has been shown to be higher among disadvantaged groups with less education,<sup>24,25</sup> unskilled occupations,<sup>26</sup> lower income<sup>27,28</sup> or lower socio-economic status in general.<sup>23,28</sup> RTD might thus be aggravating socio-economic disadvantages already present in the population affected, owing -among other things- to important changes in economic activity due to the onset or worsening of disability, health reasons and disability-related early retirement.

Traffic crashes cause 14% more mobility-related disability than do other causes. This could be explained by the type of injury suffered, in that this mainly gives rise to osteoarticular impairments affecting the lower limbs and spinal cord, in line with previous results which show that the musculoskeletal support system, essentially the legs and pelvis, is the region most affected by RTCs.<sup>29–31</sup> Assuming that RTCs can generate major injuries and limitations almost immediately, age at disability onset was presumed to be close to the date of the accident, so that our results would suggest that over half of all disabled persons had their accident before the age of 35 years; this figure reinforces and matches previous data, which define the most vulnerable population group as being young adults.<sup>1,3,5,9,19,32</sup> However, this information should be interpreted in the context of the age distribution of the sample, where around one in two people have less than fifty years old.

Persons with disability have a considerably more negative self-reported health status than that of the general population<sup>6</sup>, and this situation holds true for disability caused by RTCs. This condition, taken together with their low socio-economic status, reinforces the idea that socio-economic circumstances, more than other known risk factors, create major differences in health status.<sup>33</sup>

As Pereda et al. point out, “disabled persons have more need of medical consultation and health/social services than does the general population because they are a group with greater health problems.”<sup>6</sup> RTD generates a major need for these types of services/consultation in a group with few technical aids and personal care, which could indicate their degree of involvement and dependence. The RTD-sufferer receives more financial benefits or compensation which could be due to the role of compulsory third-party insurance and indemnity payable to traffic accident victims under the Spanish Motor Vehicle Civil Liability Insurance Act.<sup>34</sup> The

accessibility and commuting problems of the disabled in Spain have been previously described, with these being shown to be more frequent in the older population (age >65 years).<sup>6</sup> RTD-sufferers have a greater risk of experiencing these, a situation that may exacerbate their high degree of mobility-related disability, thereby increasing their level of dependence and limiting their activities in and outside the home.

Although there were no important differences in the expenditure generated by disability, the items of expenditure relating to adaptations, transport, commuting, schooling and housing were the most important in RTD. It would thus seem vital to analyse the social cost of disability caused by RTCs.

Previous studies have ascertained that there is an increased risk of disability following an RTC,<sup>16,35</sup> and our results could be suggesting that this risk is especially important in a younger segment of the population. This study was undertaken using a different data source, in order to provide a new view of the problem, complement the information currently available and support the relevance of RTD as a public health problem. Notwithstanding this, there continues to be little scientific information on the subject, and the research that has been conducted indicates a lack of homogeneity in the data sources and the methods applied, which hinders comparisons at an international level.

This study has several limitations and strengths. Among its limitations, the EDAD2008 is a specific survey of disability, which unfortunately does not explore the causes of disability in detail and so does not allow for the characteristics of road traffic crashes to be known. Using the currently available format, information cannot be linked with other RTC databases in order to supplement our existing data. Although the analyses were performed using a complex sample design, it is nevertheless possible that some of the multiple comparisons may have proved significant by chance. Among the study's strengths is the large size and representativeness of the adult population of the country as a whole.

To conclude, prevalence of RTD in Spain is lower than in other developed countries, with middle-aged and socio-economically underprivileged population being at greatest risk. The disadvantages observed in basic socio-economic characteristics, health/social conditions and economic activity make such persons a particularly vulnerable group, with high needs in terms of social and health-care support.

### What is already known on this subject

The morbidity and disease burden caused by road traffic crashes (RTCs) are both well documented but their impact on disability has been little studied. There are few studies that use specific disability surveys to describe the consequences of RTCs in terms of disability, and most of these have been conducted in developing countries.

### What this study adds

This is the first study on road traffic disability in a southern European country to use population-based disability-specific data and be conducted under the International Classification of Functioning, Disability and Health. It complements information on RTCs and facilitates international comparisons.

### Editor responsible for the article

Miguel Angel Negrín

### Authorship Contributions

R Palmera-Suárez, T López-Cuadrado, R Fernández-Cuenca and I Galán have contributed to the concept and design of the project. J Almazán-Isla and E Alcalde-Cabero have contributed to the collection, review, standardization and appropriateness of databases. R Palmera-Suárez, T López-Cuadrado and I Galán collaborated on the analyses, interpreting the results and writing the article. R Palmera-Suárez, T López-Cuadrado and I Galán had access to all data and are responsible for the overall content. All authors reviewed and approved the final version.

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### Competing interest

None declared

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### References

- World Health Organization (Internet). Road Status Report of Road Safety: Time for action. (Accessed 12/11/2014). available in: <http://www.un.org/ar/roadsafety/pdf/roadsafetyreport.pdf>
- World Health Organization (Internet). Injury: A Leading Cause of the Global Burden of Disease. (Accessed 12/11/2014). available in: [http://www.who.int/violence\\_injury\\_prevention/publications/other\\_injury/injury/en/](http://www.who.int/violence_injury_prevention/publications/other_injury/injury/en/)
- World Health Organization (Internet). World report on road traffic injury prevention. (Accessed 12/11/2014). available in: [http://www.who.int/violence\\_injury\\_prevention/publications/road\\_traffic/world\\_report/en/](http://www.who.int/violence_injury_prevention/publications/road_traffic/world_report/en/)
- Nantulya VM, Reich MR. The neglected epidemic: road traffic injuries in developing countries. *BMJ*. 2002;324:1139-41.
- Rosenberg ML, McIntyre MH, Sloan R. Global road safety. *Inj Control Saf Promot*. 2004;11:141-3.
- Pereda C, de Prada MA, Actis W. Discapacidades e inclusión social. Colección Estudios Sociales nº 33. 1º ed. Barcelona: Obra Social la Caixa; 2012. 218 p.
- Tolon-Becerra A, Lastra-Bravo X, National Flores-Parra I. regional analysis of road accidents in Spain. *Traffic Inj Prev*. 2013;14:486-95.
- Génova-Maleras R, Catalá-López F, de Larrea-Baz NF, et al. The burden of premature mortality in Spain using standard expected years of life lost: a population-based study. *BMC Public Health*. 2011;11:787.
- Cubí P, Herrero C. Evaluación de riesgos y del impacto de los accidentes de tráfico sobre la salud de la población española (1996-2004). 1º Edición. Bilbao: Fundación BBVA; 2008. 423 p.
- Ameratunga SN, Norton RN, Bennett DA, et al. Risk of disability due to car crashes: a review of the literature and methodological issues. *Injury*. 2004;35:1116-27.
- Instituto Nacional de Estadística -INE- (Internet). Metodología de la Encuesta Nacional de Discapacidad, Autonomía personal y situaciones de Dependencia 2008. (Accessed 12/11/2014). available in: <http://www.ine.es/jaxi/menu.do?type=pcaxis&path=/t15/p418&file=inebase&L=0>
- Instituto Nacional de Estadística -INE- (Internet). Encuesta Nacional de Discapacidad, Autonomía personal y situaciones de Dependencia 2008: Evaluación de la falta de respuesta. (Accessed 12/11/2014). available in: <http://www.ine.es/jaxi/menu.do?type=pcaxis&path=/t15/p418&file=inebase&L=0>
- World Health Organization (Internet). International Classification of Functioning, Disability and Health -ICF-. (Accessed 12/11/2014). available in: <http://www.who.int/classifications/icf/en/>
- Leveque A, Coppieters Y, Lagasse R. Disabilities secondary to traffic accidents: what information is available in Belgium? *Inj Control Saf Promot*. 2002;9:113-20.
- Ferrando J, Plasencia A, MacKenzie E, et al. Disabilities resulting from traffic injuries in Barcelona, Spain: 1-year incidence by age, gender and type of user. *Accid Anal Prev*. 1998;30:723-30.
- Li L, Roberts I, Power C. Physical and psychological effects of injury. Data from the 1958 British birth cohort study. *Eur J Public Health*. 2001;11:81-3.
- Lin T, Li N, Du W, et al. Road traffic disability in China: prevalence and socio-demographic disparities. *J Public Health (Oxf)*. 2013;35:541-7.
- Chen H, Du W, Li N, et al. The socioeconomic inequality in traffic-related disability among Chinese adults: the application of concentration index. *Accid Anal Prev*. 2013;55:101-6.
- Dirección General de Tráfico -DGT- (Internet). Las principales cifras de siniestralidad vial. España 2011. (Accessed 12/11/2014). available in: <http://www.dgt.es/seguridad-vial/estadisticas-e-indicadores/publicaciones/principales-cifras-siniestralidad/>
- Sethi D, Racioppi F, Baumgarten I, et al. Reducing inequalities from injuries in Europe. *Lancet*. 2006;368:2243-50.
- Laflamme L. Road Traffic Injuries. In: World Health Organization, editor. Socio-economic differences in injuries risk: A review of findings and a discussion of potential countermeasures. 1º ed. Copenhagen: 2009. p. 11-3.
- Hyder AA, Peden M. Inequality and road traffic injuries. *Call for action Lancet*. 2003;362:2034-5.
- Chen HY, Ivers RQ, Martiniuk LC, et al. Socioeconomic status and risk of car crash injury, independent of place of residence and driving exposure: results from the DRIVE study. *J Epidemiol Community Health*. 2010;64:998-1003.
- Murray A. The home and school background of young drivers involved in traffic accidents. *Accid Anal Prev*. 1998;30:169-82.
- Ferrando J, Rodríguez-Sanz M, Borrell C, et al. Individual and contextual effects in injury morbidity in Barcelona (Spain). *Accid Anal Prev*. 2005;37:85-92.
- Hasselberg M, Laflamme L. Road traffic injuries among young car drivers by country of origin and socioeconomic position. *Int J Public Health*. 2008;53:40-5.
- Chakravarthy B, Anderson CL, Ludlow J, et al. The relationship of pedestrian injuries to socioeconomic characteristics in a large Southern California County. *Traffic Inj Prev*. 2010;11:508-13.
- Hanna CL, Hasselberg M, Laflamme L, et al. Road traffic crash circumstances and consequences among young unlicensed drivers: a Swedish cohort study on socioeconomic disparities. *BMC Public Health*. 2010;10:14.
- Esiyok B, Korkusuz I, Canturk G, et al. Road traffic accidents and disability: a cross-section study from Turkey. *Disabil Rehabil*. 2005;27:1333-8.
- Lund J, Bjerkedal T. Permanent impairments, disabilities and disability pensions related to accidents in Norway. *Accid Anal Prev*. 2001;33:19-30.
- Malm S, Krafft M, Kullgren A, et al. Risk of permanent medical impairment (RPMI) in road traffic accidents. *Ann Adv Automot Med*. 2008;52:93-100.
- Gururaj G. Road traffic deaths, injuries and disabilities in India: current scenario. *Natl Med J India*. 2008;21:14-20.
- López Casasnovas G, Ortún V. Los determinantes de la salud. In: López Casasnovas G, Ortún V, Encuentro, editors. Economía y salud. Fundamentos y políticas. 1º ed Madrid: Oikos Nomos; 1998. p. 100-4.
- Ministerio de la Presidencia - Gobierno de España (Internet). Ley de Responsabilidad Civil y Seguro en la Circulación de Vehículos de Motor. (Accessed 12/11/2014). available in: <http://www.boe.es/buscar/act.php?id=BOE-A-2004-18911&p=20130130&tm=2>
- Berglund A, Alfredsson L, Jensen I, et al. The association between exposure to a rear-end collision and future health complaints. *J Clin Epidemiol*. 2001;54:851-6.