



Gender differences in road traffic injury rate using time travelled as a measure of exposure



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ABSTRACT

There is no consensus on whether the risk of road traffic injury is higher among men or among women. Comparison between studies is difficult mainly due to the different exposure measures used to estimate the risk. The measures of exposure to the risk of road traffic injury should be people's mobility measures, but frequently authors use other measures such population or vehicles mobility. We compare road traffic injury risk in men and women, by age, mode of transport and severity, using the time people spend travelling as the exposure measure, in Catalonia for the period 2004–2008. This is a cross-sectional study including all residents aged over 3 years. The road traffic injury rate was calculated using the number of people injured, from the Register of Accidents and Victims of the National Traffic Authority as numerator, and the person-hours travelled, from the 2006 Daily Mobility Survey carried out by the Catalan regional government, as denominator. Sex and age specific rates by mode of transport and severity were calculated, and Poisson regression models were fitted. Among child pedestrians and young drivers, males present higher risk of slight and severe injury, and in the oldest groups women present higher risk. The death rate is always higher in men. There exists interaction between sex and age in road traffic injury risk. Therefore, injury risk is higher among men in some age groups, and among women in other groups, but these age groups vary depending on mode of transport and severity.

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1. Introduction

There is evidence that the risk of road traffic injury varies by gender, but there is no consensus over whether it is higher among men or among women. Comparison between studies is difficult due to the different populations studied, in terms of mode of transport (drivers or users – i.e. drivers or passengers – of cars and or two-wheeled motor vehicles, cyclists, pedestrians, etc), or in terms of injury severity (fatal or non-fatal injury, any injury regardless of severity, being involved in a collision with victims regardless of severity, etc.). But above all, comparison between studies is difficult due to the different exposure measures used to estimate the risk of injury (population, vehicle fleet, census of drivers, vehicle mobility –vehicle-kilometers travelled-, people's mobility distance or time travelled, etc.).

For any event in epidemiology, risk ought to be estimated based on the calculation of rates, in which the denominator should be a measure of the quantity of person-time at risk. In the case of road traffic crashes the measures of exposure to the risk of injury should be defined through the various ways of quantifying people's mobility, whether by vehicle or on foot, and as a function of distance or time travelled (European Traffic Safety Council ETSC, 1999). Various authors have estimated the road traffic injury risk using people's mobility as the exposure. However, the majority of these studies are based on drivers involved in collisions or in collisions with victims, without distinguishing whether the driver was injured or not, nor the specific mode of transport. Moreover, in spite of the fact that some of these studies have used the time people spent travelling (Chipman et al., 1992, 1993; Keall, 1995; Lee and Abdel-Aty, 2005; Rodgers, 1995) and others have used the number of trips made (Beck et al., 2007), the majority use the distance travelled as driver of a vehicle as the exposure (Chipman et al., 1992, 1993; Kweon and Kockelman, 2003; Lardelli-Claret et al., 2011; Keall and Newstead, 2009; Harrison and Christie, 2005; Massie et al., 1995, 1997; Al-Balbissi, 2003), meaning non-motorized modes of transport cannot be studied.

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According to the findings of those studies, there are contradictions in relation to differences in road traffic injury risk between men and women. Some studies report higher rates in men than in women in all age groups except the elderly, these differences being more marked in the youngest groups and decreasing as age increases (Al-Balbissi, 2003; Chipman et al., 1993; Massie et al., 1995, 1997). Another study reported higher rates in men than in women, in the youngest and the oldest age groups (Williams, 2003). In contrast, other authors reported similar rates for male and female drivers of the same age, and some others even report higher rates of non-fatal injuries among women over 25 years than among men of the same age (Kweon and Kockelman, 2003; Massie et al., 1995). Beck et al., (2007) estimated the injury rate by sex and by mode of transport including non-motorized modes and using the number of trips people made as the exposure measure. They reported higher risk in men than in women for all users except motorcycle drivers, regardless of age (Beck et al., 2007).

In order to estimate exposure to road traffic injury risk, mobility and transport surveys constitute a useful tool for measuring people's mobility. The 2006 Catalan Daily Mobility Survey (EMQ2006) was a transport survey representative of the Catalan population which collected information about individuals and about all their trips during one day. This provides an opportunity to obtain measures of people's mobility taking into account their individual characteristics. Thus, the objective of the present study is to compare the risk of road traffic injury in men and women, by age, mode of transport and injury severity, using the time people spend travelling as the exposure measure, in Catalonia for the period 2004–2008.

2. Materials and methods

2.1. Design and study population

This is a cross-sectional study and the study population includes all residents of Catalonia aged over 3 years, in the period 2004–2008. Catalonia is a region located in the North–east of Spain, with approximately seven million inhabitants.

2.2. Information sources

The Register of Accidents and Victims of the National Traffic Authority provides information about people injured in traffic collisions in Spain.

The 2006 Catalan Daily Mobility Survey (EMQ2006) carried out by the Catalan regional government (Departament de Política Territorial i Obres Públiques de la Generalitat de Catalunya, and Autoritat del Transport Metropolità), provides information about mobility of the population aged over 3 years in Catalonia in 2006. This survey employed a computer-assisted telephone interviewing (CATI) technique to interview a representative sample of the population of Catalonia. Data were collected using multistage stratified sampling, firstly selecting territory (counties and towns of over 50,000 inhabitants) and then selecting the individuals to be interviewed, applying quotas for age and sex, covering the whole of Catalonia. A total of 106,091 people were interviewed in 2006 between March and June, and between September and December, and mobility data were collected for 95,644 individuals who made some trip the day before the interview. In general, the survey collects information about participants and the trips they made during the day before the interview, but when the interview took place on a Monday, information was collected referring to the previous Friday, and in the same interview, 50% of participants were also asked about their mobility on the Saturday, and 50% about their mobility on the Sunday. For every trip, the day, reason, origin,

destination, starting time and duration were collected (Institut d'Estudis Regionals i Metropolitans de Barcelona, 2008).

2.3. Variables

The dependent variable is the number of people aged over 3 years injured in traffic crashes in Catalonia between 2004 and 2008. It includes people suffering both slight and severe injuries (requiring admission to hospital for more than 24 h) as well as people who die (whether at the scene of the accident, on the way to hospital, or in hospital during the 24 h following the accident).

The explanatory variables used are: sex; age group (4–11, 12–13, 14–17, 18–24, 25–34, 35–44, 45–54, 55–64, 65–74, and >74 years), employing groups sufficiently small to permit detecting changes in injury risk taking into account mobility patterns of different population groups, defined for example by ages when people may begin to ride a moped – 14 years – or drive a car – 18 years – retirement age – 65 years, etc.; mode of transport (car driver; motorcycle or moped driver; bicycle; bus; and on foot–pedestrian); and injury severity (slight, serious and fatal).

The exposure variable used is the total time people spent travelling, measured in hours (i.e. person-hours travelled). This variable was estimated based on the number of people who, in responding to the EMQ2006, stated they had made some trip on the day referred to in the interview. Applying post-stratification weights to scale the data to population level, specific for working days and for weekends, we obtain a population estimate for the number of residents of Catalonia travelling on a working day and on a weekend-day, the number of trips they make, and finally the population estimate for the total hours they spend travelling (person-hours travelled). As their mobility is in reference to a single day, to obtain an annual estimation, the estimate of time spent travelling on working days is multiplied by 245, the number of working days in 2006, and the time spent travelling at weekends by 120. A trip is uniquely specified by its origin and destination, and may consist of several stages defined by the different modes of transport used, but the EMQ2006 does not ask about the time spent in each mode of transport in trips involving several different modes. For such multi-stage trips (which represent 5% of all trips) the total trip time is assigned to the main mode of transport (in the order: bus, car-driver, motorcycle-driver, car-passenger, motorcycle-pillion passenger, bicycle, walking trip).

2.4. Statistical analysis

In order to describe the impact of traffic injuries in different population groups in Catalonia during the period 2004–2008, taking their mobility into account, the annual road traffic injury rate was calculated, in each group, using the number of people injured in this period as numerator, and the estimate of person-hours travelled in 2006 multiplied by 5, the length of the study period in years, as denominator. The formula used for calculating the injury rate was:

$$\left(\frac{\text{(number of people injured in the period 2004–2008)}}{\text{((number of person-hours travelled on a working day in 2006} \times 245 \text{ working days in 2006) + (number of person-hours travelled on a weekend-day in 2006} \times 120 \text{ weekend-days in 2006))}} \right) \times 5 \text{ years in the period 2004–2008}} \times 10,000,000$$

The rate is expressed as people injured per 10 million person-hours travelled and provides an estimate of the road traffic injury risk. Sex- and sex/age-specific rates by mode of transport and severity were calculated. The 95% Confidence Intervals for the rates were calculated using the Poisson distribution (Szclo and Nieto, 2003). Rates for groups with less than 10 people injured are not reported.

In order to compare road traffic injury risks between men and women, the Relative Risk (RR) of suffering a road traffic injury

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