Road traffic injuries, mobility and gender. Patterns of risk in Southern Europe

Guadalupe González-Sánchez[a], Elvira Maeso-González[b], María Isabel Olmo-Sánchez[a], Mario Gutiérrez-Bedmar[c,*], Alberto Mariscal[c], Antonio García-Rodríguez[c]

[a] Transportation Management Unit, University of Malaga, Bus Station, Pso. de Los Tilos s/n, Malaga 29006, Spain
[b] Department of Economics and Business Administration, School of Engineering, University of Malaga, C/ Dr. Ortiz Ramos s/n, Malaga 29071, Spain
[c] Department of Public Health and Psychiatry, Faculty of Medicine, University of Malaga, Boulevard Louis Pasteur 32, Malaga 29071, Spain

ARTICLE INFO

ABSTRACT

Background: The identification of risk groups for road traffic injuries (RTI) is essential for effective prevention strategies. This information is still limited in several geographical areas. The aim of this study was to evaluate the risk of RTI according to gender, age, mode of transport, type of journey and injury severity in a Southern European region.
Methods: A cross-sectional study was conducted during the period from January 2008 to December 2013 in Andalusia (South of Spain). We estimated the specific morbidity rates by gender, mode of transport and age. The relative risk assessment was performed by Poisson regression models adjusted by gender, age, type of journey, injury severity and mode of transport. The measure of exposure was person − hours travelled.
Results: Except for pedestrians, the highest RTI rates were found in women. This pattern was still fulfilled in minor injuries. In serious and fatal injuries, the trend was reversed with the risk of increased RTI in men. The most hazardous mode of transport was motorcycles, while public transport was the safest. Injury severity was positively associated with age for all modes of transport, except motorcycles where the opposite was the case. Finally, the risk of serious or fatal injury was greater in long-distance trips.
Conclusions: In our Southern European region, preventive strategies should be targeted in men, young and older people, motorcycles and long-distance drivers, as they present a higher risk of serious and fatal injuries.

1. Introduction

Traffic accidents are acknowledged as one of the most important problems affecting public health worldwide. According to the World Health Organisation, each year 1.25 million people die as a result of road traffic accidents, notwithstanding the improvements achieved in terms of road safety (WHO, 2015).

A Road Traffic Injury (RTI) is a fatal or non-fatal injury incurred as a result of a collision on a public road involving at least one moving vehicle (WHO, 2016). Although there exist large and comprehensive data sets on road accident in Europe, like Community database on Accidents on the Roads in Europe (CARE), epidemiological research in RTI prevention is still limited. One limitation is the lack of such research in some important geographical areas like Southern European regions. Another limitation concerns the measure of mobility (i.e. exposure). In order to estimate accurate RTI rates, it is essential to use adequate measures of exposure to

* Corresponding author.
  E-mail address: bedmar@uma.es (M. Gutiérrez-Bedmar).

traffic accidents. A large variety of these measures are employed in studies in this field. Some authors use more general measures of exposure, such as population figures (Bahadorimonfared et al., 2013; Licaj et al., 2011; Majdan et al., 2015). Other studies have employed the number of users of each mode of transport (Berecki-Gisolf et al., 2015; Licaj et al., 2011; Martínez-Ruiz et al., 2015, 2014) and the total number of vehicles on the road (Bahadorimonfared et al., 2013). Some studies have even used the price of petrol or the unemployment rate as measures of exposure (Obeng, 2011). The need to include a reliable measure of exposure is increasingly more important for research into RTI. So, other studies employ more precise measures of exposure to quantify the mobility of people, such as the distances covered (Al-Balbissi, 2003; Licaj et al., 2011; Lovelace et al., 2015; Martinussen et al., 2013; Massie et al., 1997, 1995; Obeng, 2011; Papa et al., 2014; Poulos et al., 2015), travel time (Ferrando et al., 1998; Poulos et al., 2015; Santamariña-Rubio et al., 2014; Yao et al., 2015) and the number of journeys made (Beck et al., 2007). Therefore, although there are epidemiological studies on RTI prevention, the use of a precise measure of exposure is scarce. The need to reduce the number of victims of traffic accidents requires epidemiological studies with an accurate measure of people mobility.

The aim of this study is to evaluate the risk of RTI on a working day, according to gender, age, mode of transport, injury severity, and type of journey, using the time people spent on travelling as a measure of exposure, in order to help identify the specific high-risk groups of RTI in a Southern European region, as no studies have been found to date on this issue. We have considered working days (Monday–Friday) because they have a more uniform travel pattern than weekends and it can provide us more consistent results.

2. Material and methods

2.1. Design and study population

It is a cross-sectional study in which the study population included all the residents of Andalusia (South of Spain) over 15 years old, during the period from January 2008 to December 2013. Andalusia is one of the largest and most populated Communities of Spain, covering an area of 87,597 km^2 and with an average population of 8.4 millions inhabitants.

2.2. Data source

We used two data sources. The first one was the mobility survey in Andalusia (Institute of Statistics and Cartography of Andalusia, 2011), carried out by the region´s Institute of Statistics and Cartography, which was taken by 5767 people between September 13rd and November 25th, 2011 offering information on their journeys. For each participant, it was collected the mobility of the previous working day at which the survey was made. The survey was conducted from Tuesday to Saturday to prevent people responding on Monday had to remember their mobility three days earlier. The second information source was the Register of Accidents and Victims of the National Traffic Authority for the period 2008–2013 (Dirección General de Tráfico, 2015), which included all road traffic accidents with victims registered in Spain from 2008 to 2013. From this register, we extracted all traffic accidents which occurred in Andalusia during the study period. Due to the fact that the mobility survey considers only a sample of the Andalusian population, it was necessary to use a sample weighting to describe the whole population on the basis of the sample. 276 different weights have been used, depending on the gender of the respondent and the geographic area in which they lived. A detailed description of this sample weighting can be found elsewhere (Institute of Statistics and Cartography of Andalusia, 2011).

2.3. Measures and statistical analysis

Several rates of RTI have been used in previous studies. The main difference among these rates is the measure of exposure contemplated (rates with respect to population, gasoline prices, distance travelled, number of trips, etc.). As a measure of exposure to RTI, we used the time spent by people on their journeys. We have used the total time spent travelling by persons as it is one of the Risk Exposure Data of major interest for road safety by the EC project SafetyNet (2004). This data was obtained by multiplying this time, provided by the mobility survey, by 249 (the number of working days in 2011). The sample was then raised to obtain the exposure time for the entire population of Andalusia.

The main outcome was the number of injuries due to traffic accidents, after a collision on a public road involving at least one moving vehicle (RTI). The covariates were: age, gender, mode of transport, type of journey, and injury severity.

The RTI rates were calculated using Eq. (1).

$$\frac{\text{Road traffic accident victims aged 16 and over on working days (2008} - \text{2013)}}{(\text{No. person} - \text{hours travelled on a working day in 2011} \times 249 \text{ working days/year}) \times 6 \text{ years}} \times 10{,}000{,}000 \tag{1}$$

This rate was expressed as victims per 10 million person-hours travelled and provided an estimation of the risk of RTI.

To estimate the relationship between RTI and the covariates, a Poisson regression model was created for each mode of transport to estimate the adjusted relative risk (RR) and 95% confidence intervals (CIs). The Poisson distribution, also called law of rare events, states that, the total number of events will follow a Poisson distribution if an event can occur at any point in time or space under observation but the probability of occurrence at a given point is small, as is the case with traffic accidents. This methodology has been used successfully in similar studies. The number of road traffic victims aged 16 and over on a working day was taken as the dependant variable. Victims incurring minor (hospitalized less than 24 h or not hospitalized) and serious (hospitalized more than 24 h) injuries, as well as fatalities (death occurring within 24 h after the accident) were included. The independent variables were as follows: gender