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Road crash fatality rates in France: A comparison of road user types, taking account of travel practices

Liacine Bouaoun [a,b,c], Mohamed Mouloud Haddak [a,b,c,*], Emmanuelle Amoros [a,b,c]

[a] Université de Lyon, F-69622 Lyon, France
[b] Epidemiological Research and Surveillance Unit in Transport, Occupation and Environment (UMRESTTE), French Institute of Science and Technology for Transport, Development and Networks (IFSTTAR), Cité des Mobilités, 25 Avenue François Mitterrand, F-69675 Bron, France
[c] Université Lyon 1, UMRESTTE, F-69373 Lyon, France

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ABSTRACT

Background: Travel practices are changing: bicycle and motorized two-wheeler (MTW) use are rising in some of France's large cities. These are cheaper modes of transport and therefore attractive at a time of economic crisis, but they also allow their users to avoid traffic congestion. At the same time, active transport modes such as walking and cycling are encouraged because they are beneficial to health and reduce pollution. It is therefore important to find out more about the road crash risks of the different modes of transport. To do this, we need to take account of the number of individuals who use each, and, even better, their travel levels.

Method: We estimated the exposure-based fatality rates for road traffic crashes in France, on the basis of the ratio between the number of fatalities and exposure to road accident risk. Fatality data were obtained from the French national police database of road traffic casualties in the period 2007–2008. Exposure data was estimated from the latest national household travel survey (ENTD) which was conducted from April 2007 to April 2008. Three quantities of travel were computed for each mode of transport: (1) the number of trips, (2) the distance traveled and (3) the time spent traveling. Annual fatality rates were assessed by road user type, age and sex.

Results: The overall annual fatality rates were 6.3 per 100 million trips, 5.8 per billion kilometers traveled and 0.20 per million hours spent traveling. The fatality rates differed according to road user type, age and sex. The risk of being killed was 20 to 32 times higher for motorized two-wheeler users than for car occupants. For cyclists, the risk of being killed, both on the basis of time spent traveling and the number of trips was about 1.5 times higher than for car occupants. Risk for pedestrians compared to car occupants was similar according to time spent traveling, lower according to the number of trips and higher according to the distance traveled. People from the 17–20 and 21–29 age groups and those aged 70 and over had the highest rates. Males had higher rates than females, by a factor of between 2 and 3.

Conclusion: When exposure is taken into account, the risks for motorized two-wheeler users are extremely high compared to other types of road user. This disparity can be explained by the combination of speed and a lack of protection (except for helmets). The differential is so great that prevention measures could probably not eliminate it. The question that arises is as follows: with regard to public health, should not the use of MTW, or at least of motorcycles, be deterred? The difference between the fatality risk of cyclists and of car occupants is much smaller (1.5 times higher); besides, there is much room for improvements in cyclist safety, for instance by increasing the use of helmets and conspicuity equipment. Traffic calming could also benefit cyclists, pedestrians and perhaps moped users.

1. Introduction

According to the World Health Organization, road traffic injuries were the tenth leading cause of death worldwide in 2008 and, unless immediate action is taken, they will become the fifth leading cause of death by 2030 (World Health Organization, 2011).

* Corresponding author at: IFSTTAR, UMRESTTE UMR T 9405, Cité des Mobilités, 25 Avenue François Mitterrand, 69675 Bron Cedex, France. Tel.: +33 4 72 14 25 14; fax: +33 4 72 37 68 37.
E-mail address: mouloud.haddak@ifsttar.fr (M.M. Haddak).

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In France, as in other countries, road traffic deaths are a burden for society. In 2008, the fatality rate was 69 per million inhabitants in France, whereas it was 43 in UK and Sweden (Onisr, 2009; International Traffic Safety Data and Analysis Group (IRTAD), 2010).

When promoting active modes of transport, i.e., walking and cycling, with a view to improving public health (Programme National Nutrition Santé, 2001; World Health Organization, 2004a), it is important to improve our knowledge about the crash risk associated with these two modes of transport and to compare them with other modes, in particular the car as this is the most frequently used mode, but also MTWs whose use is increasing in some major cities (Kopp, 2011). The use of bicycles is also on the increase in some large cities (Papon and De Solère, 2010). These two modes have two similar advantages for their users. First, they allow them to avoid most traffic congestion, and second, they are less expensive than car use, which is an asset at a time of economic crisis. In order to compare the crash risks of different modes of transport we must have appropriate measures of their use. The number of vehicles or number of users provided an approximate starting point. The best approach is to measure road users' travel levels (Elvik and Vaa, 2004; Elvik et al., 2009; Santamariña-Rubio et al., 2013). This can be done on the basis of number of trips (Pucher and Dijkstra, 2000; Beck et al., 2007; De Geus et al., 2012), distance traveled (Pucher and Dijkstra, 2003; Harrison and Christie, 2005; Christie et al., 2007; Pucher and Buehler, 2008; Elvik, 2009; De Geus et al., 2012) or time spent traveling (Tin Tin et al., 2010; De Geus et al., 2012). Distance traveled is the most frequently used of these, as it can be approximately measured on the basis of petrol sales and the fleet of motor vehicles. In this study, by using a travel survey, we can estimate all three quantities of road users' travel. The first, the number of trips, provides an initial indicator of users' travel. The best way of refining this indicator is to take account of distance traveled or time spent traveling. We shall present the fatality risks for these three measures, as they do not reveal the same information. We tend to favor the time spent traveling over the distance traveled, as time spent traveling is less elastic (Schafer, 2000), i.e., time spent traveling during a day is fairly similar across different road user types, whereas distance traveled is not.

With regard to crash risk, we have restricted this study to fatality risk, as road fatalities are well-reported whereas non-fatal casualties are not (Amoros et al., 2006). This is the case both in France and worldwide (Elvik and Mysen, 1999).

Our fatality data was provided from the French national road crash database and our travel data was computed from the latest national household travel survey (ENTD).

2. Materials and methods

2.1. Data

Two data sources were used. The travel data were provided by the latest French National Travel Survey (ENTD) conducted in 2007–2008 (SOeS, 2010). Data collection was spread over one full year (April 2007 to April 2008), in 6 waves, in order to eliminate seasonal variations in travel.

This survey was based on a sample of 20,200 surveyed households, making it the largest travel survey ever conducted in France (Grimal, 2010; Armoogum et al., 2011).

This survey was conducted by the Ministry of Transport, and it was mandatory for selected individuals to participate. The survey is in two stages. During the first stage, general information on the 20,200 households was collected (the response rate was 77.9%). This information included socio-demographic data, a description of all vehicles available in the household, and a description of the household's residential area, with such information as the availability of public transport nearby.

During the second stage, a person (aged 6 years and over) was selected by the Kish method (Kish, 1965). Moreover an unequal probability distribution was used to over-represent individuals who travel a great deal. At this stage almost 18,700 people were interviewed (the response rate was 92.3%, but 7.7% of households were lost to follow-up between the 1st and 2nd stages).

The Kish individuals were asked to describe all their short and long trips. Short trips were defined as those within an 80 km radius of home and long trips were defined as any trip beyond this. The description of short trips was based on all the trips made on one weekday and one weekend day (either Saturday or Sunday) before the interview. The collected information included, for each trip, the mode(s) of transportation used, the distance covered, the time spent traveling and the purpose of the trip (Armoogum et al., 2011). A trip could only have one purpose, and could include one or more transport modes (for instance, a trip to work could include walking to the bus station, taking the bus, and walking from another bus station to the office). However the survey selected a dominant mode for each trip. this was based on the hierarchy of weights: (1) walking, or using (2) a bicycle, (3) a MTW, (4) a car, or (5) public transport.

We estimated three quantities of road users' travel: the number of trips, the distance traveled, and the time spent traveling. The number of trips provides an initial rough measure of travel level. As mentioned above, distance traveled is often used, as it was the first indicator to be estimated using data on petrol sales and the fleet of vehicles. The time spent traveling has the advantage of being the least elastic measure (Schafer, 2000); in other words, the time-budget is more comparable across road users than the distance-budget.

Our crash data were obtained from the French national road crash database, which is based on police crash reports (Onisr, 2009). A road crash is defined as a crash causing at least one casualty (injured or killed), involving at least one vehicle, occurring on a road that is open to public traffic. The police report collects data on the crash environment (type(s) of road, type of intersection etc.), the environmental conditions, the characteristics of the vehicles involved and information on the persons injured or killed. Fatalities are defined as deaths that occur at the scene or within 30 days of the crash. We selected the crash data in accordance with the population studied in the national travel survey: individuals aged 6 years and over, living in metropolitan France and who were killed in a crash that occurred in 2007 or 2008.

2.2. Statistical analysis

The risk of fatal road crashes is defined as a ratio, in which the numerator is the number of fatalities occurring during the study period and the denominator is the measure of exposure during the same period.

We estimated the annual fatality rates by using three different measures of exposure: number of trips, distance traveled and time spent traveling. The exposure data were weighted to take account of the design of the survey sample.

Fatality rates were computed according to gender, age and road user type. Age was classified into the same categories as a recent study (Mindell et al., 2012) to allow direct comparisons: [6–16], [17–20], [21–29], [30–39], [40–49], [50–59], [60–69] and [70+].

The following road user types were studied: pedestrians (including skateboard and roller skate users), cyclists, motorized two-wheeler (MTW) users (including motorcycles, mopeds and quads), car occupants (including individuals in taxis and light goods vehicles), and (road) public transport users (including buses, coaches, trams and trolleybuses).