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Contextual deprivation, daily travel and road traffic injuries among the young in the Rhône *Département* (France)

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ABSTRACT

This study investigated the effect of the socioeconomic level of the municipality of residence on personal injury road traffic accident risk among young persons of 10–24 years of age in the Rhône *Département*. This effect was assessed by comparing incidences of injuries ($n = 2792$ casualties) on the basis of three denominators: the resident population of young people, the number of users of each mode and the distances covered by each mode. The results are presented for each type of road users (pedestrians, car passengers, car drivers, motorised two-wheeler riders, cyclists, public transport users).

Young persons from deprived municipalities use motorised-two wheelers, bicycles and the car (as passengers and drivers) less frequently, they walk more and take public transports more often than those from other municipalities.

When considering injury risk, motorised two wheeler injuries among adolescent males, for example, are significantly less frequent in deprived municipalities. But the motorised two-wheeler riders as well as car passengers from deprived municipalities are characterized by an excess injury risk, whether the selected denominator is the number of users or the kilometres travelled by this mode.

For the first time in France, this study has enabled a comparison of the effects of a contextual socioeconomic indicator (the type of municipality of residence, deprived, or not) on daily travel practices and injury incidences among the population, among the users of each mode and per km of travel.

1. Introduction

Worldwide, road traffic injuries are the principal cause of mortality among young people in the 10–24 year-old age bracket (WHO, 2007). A number of studies have shown that young people belonging to underprivileged social groups have more road traffic injuries than their more socially advantaged counterparts (Cubbin et al., 2000; Hasselberg et al., 2001; Hippisley-Cox et al., 2002; Ferrando et al., 2005; Edwards et al., 2008; Fleury et al., 2010). The evidence suggests that explanations for these differences should be sought in variations in exposure to risk, rather than in behaviour (Laflamme, 1998), though behavioural differences do play some role. Exposure to road risk is defined on the basis of the conditions and forms of travel and the number of trips. Some studies employ measures of risk exposure such as distance travelled, number of intersections crossed or trip duration (Thouez et al., 2005; Spallek et al., 2006; Jungwook et al., 2007a,b).

In France, and particularly in the Rhône *Département*, road traffic injuries peak for males between 15 and 17 years of age and for females between the 22 and 24 years of age (Haddak et al., 2010). The minimum legal age for riding a motorized two-wheeler is 14 and for driving a car 18 (except in the case of accompanied driving for 16–17 years-old).

Although the study of leisure trips is essential in order to gain an understanding of how young people acquire the capacity for independent travel (Massot and Zaffran, 2007), investigation of the daily mobility of children and adolescents has primarily focused on their home-to-school trips (Hjorthol and Fyhri, 2009). Various studies have shown that children's travel practices are strongly dependent not only on their age and gender but also on their parents' standard of living and their residential location (Van Vliet, 1983; Paulo, 2006; Pochet et al., 2010). The ownership or mere availability of one or more cars within the household is a key variable for understanding modal choice among the young. However, in France, the ease of access to a car is determined not only by residential location,

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but also by the household's standard of living (Claisse et al., 2000; Orfeuil, 2004; Mignot and Rosales-Montano, 2006). Low income households less frequently own two vehicles than high income households, and more frequently own no vehicle at all. In addition, they more often purchase secondhand cars and the higher average age of their vehicles (Nicolas et al., 2003) may affect their availability and influence crash risk and severity, particularly in the case of young male drivers, as has been observed in the United States (Males, 2009). The expensive cost of procuring a driving licence may affect the daily travel of low income young and therefore have consequences on social exclusion, on the example of non-western immigrants in Norway (Priya and Uteng, 2009).

The combined use of data on daily travel and road traffic injuries is still unusual in epidemiological studies. The main reason for this is that the necessary data is difficult to collect. Several measures are used to define road risk exposure, for example, the distance travelled (Pucher and Dijkstra, 2003; Harrison and Christie, 2005), the number of trips (Pucher and Dijkstra, 2003; Rice et al., 2003), the number of streets crossed in the case of pedestrians (Posner et al., 2002) and journey times (Lee and Abdel-Aty, 2005). A Canadian study from some years ago (Macpherson et al., 1998), after showing that underprivileged children between the ages of 5 and 12 crossed more roads on foot, demonstrated that there is a strong positive correlation between the number of roads crossed and the number of pedestrian injuries. However, most of these studies considered a single transport mode and did not include socioeconomic data.

This paper compares road trauma data (from the Rhône road trauma registry) with travel data in order to gain a better understanding of the origin of the social and geographical inequalities with regard to road traffic injuries which are observed in France and other industrialized countries.

The goals are as follows: first, to investigate the effect of the socioeconomic level of the municipality of residence on the use of different transport modes by young persons of 10–24 years of age in the Rhône *Département*, and second, to investigate the effect of the socioeconomic level of the municipality on personal injury road traffic accident risk as assessed on the basis of three denominators: total population, the number of users of each mode and the distances covered by each mode.

2. Materials and methods

2.1. The Rhône Département and the deprived areas

The Rhône is a French *Département* (1,600,000 inhabitants) in the Rhône-Alpes region whose main urban centre is the Lyon conurbation (1,200,000 inhabitants).

France has so-called *Zones Urbaines Sensibles* (ZUS) which are deprived areas which have been identified by the public authorities as priority targets for urban policy. These areas are characterized by large apartment buildings and relatively poor housing conditions, a pronounced imbalance between the number of dwellings and the number of jobs and low incomes. In addition, ZUS residents are more often in casual employment than those living in other areas.

The Rhône contains 293 municipalities and has a population of 1,669,600 of which 191,682 (11.5%) live in 30 ZUS's which are spread over 25 municipalities (INSEE, 2006). Some municipalities have two or even three ZUS's. Also at the time of the last census (1999), the unemployment rate stood at 22.4% in the Rhône's ZUS's, compared with 11.4% in the *Département* as a whole. In addition, the under 25-year-old age group, individuals with no qualifications and single parent families were over-represented in the ZUS's: in the ZUS's the under-25s accounted for 39.2% of the population, unqualified persons (without any formal academic qualifications) accounted for 33.3% of the population and single parent families accounted for 21.5% of the population, while the percentages for the rest of the Rhône were respectively 33.0%, 18.7%, and 13.0%.

The above characteristics show that living in a ZUS would seem to be a good indicator of poor social position. However, our data only report the residential municipality of casualties. We therefore decided to use living in a municipality with one or more ZUS's (deprived municipalities, in opposition with other municipalities: without ZUS) as an indicator. In such municipalities, on average 35% of persons of under 25 years of age live in a ZUS. In order to obtain an accurate evaluation of this socio-geographical indicator we shall compare the median taxable income per consumption unit in the two types of municipality (INSEE France 1999). The median income in the municipalities with a ZUS was €15,719 per year with an interquartile interval of [12,308–16,120] whereas in the municipalities without a ZUS, the median annual income was €19,789 with an interquartile interval that is disjoint from the previous one [17,544–21,829]. The use of this sociogeographical indicator thus allows us to consider urban contexts which are contrasting with regard to the incomes of their residents.

2.2. The Rhône registry

The Registry contains all the individuals who sustain injuries in road traffic accidents in the Rhône *Département*. A total of 282 public and private health care departments to which road traffic accident casualties may be taken contribute data to the Registry. It was developed by the UMRESTTE, in collaboration with the *Département*'s Fire and Emergency Service and the Rhône *Département* Road Trauma Registry Association (ARVAC) (Laumon et al., 1997). Certain details about the accident (location, date, time of day, vehicles involved) and some personal data about the casualty are recorded. The inclusion criteria are the location of the accident (Rhône), an accident involving a moving vehicle (including roller-skates and skateboards), and the presence of at least one AIS injury (AIS, 1990 revision). Pedestrians who fall on their own are therefore not included.

The municipality in which the accident occurs was classified according to whether or not it contained a ZUS. In the case of the city of Lyon, each district was considered to be a municipality. Casualties injured in the Rhône but living outside the Rhône (14%) were excluded.

2.3. The 2005 and 2006 household travel survey

The Lyon Household Travel Survey (HTS) we used was conducted between November 2005 and May 2006. This survey is representative of the population of households living within the study area, which includes the entire Rhône *Département*. In the 2968 surveyed households in the Rhône, the 5102 persons aged over 4 years who were interviewed individually provided information about their personal characteristics and mobility on one day. Mobility was identified on the basis of all the trips made the day before the interview. In addition, the survey collected details about respondents' customary mode use, asking them to choose between six alternatives with regard to weekday travel:

1. Every day or almost,
2. At least two trips per week,
3. At least two trips per month,
4. On an exceptional basis,
5. Never.

Details on customary usage were collected for the following modes: