Excess accident risk among residents of deprived areas, Dominique Fleury, Jean François Peytavin, Thomas Alam, Thierry Brenac, 2010, Accident Analysis & Prevention

doi:10.1016/j.aap.2010.04.004

Excess accident risk among residents of deprived areas

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Abstract

This study examines road risks among residents of deprived neighbourhoods targeted by social policy compared with residents of other contiguous neighbourhoods that are socially more privileged. The data used are from accident reports filled in by the police. When these data are brought to the level of the population in the areas studied, the adjusted relative risk for those living in sensitive urban areas compared with those living in other areas is assessed at 1.366 (with a 95% confidence interval from 1.240 to 1.502). Distributions by age and gender are then studied. In the discussion, several hypotheses concerning behaviour, mobility and socio-spatial factors are discussed.

Keywords: Deprived areas, socioeconomic differences, accident risk, age, gender.

1. Introduction

There has been a trend toward a reduction in road risks in European countries, notably in France. The number of fatalities on French roads dropped from 7,130 in 1997 to 4,443 in 2008[1] (ONISR, 2009). These results can be explained by a determined policy aimed at controlling speed and improving vehicles, but also by changes in infrastructures. Thus, in the urban planning field, many spaces have been redesigned in recent decades using traffic calming techniques (Fleury, 2001). Urban spaces differ in their design, in their socioeconomic make-up and in the attention paid to their physical treatment. One may wonder whether the residents of deprived neighbourhoods run the same road risks as those of other urban areas. Differentiating between these risks could help to guide decisions made on safety actions, integrating both the social dimensions and the spatial dimensions of the safety level (Fleury, 2006).

The general relationship between insecurity and deprivation was recently the subject of several studies. Thus, in England, an analysis of the 8,414 wards that cover the country showed, firstly, the importance of general characteristics related to urbanisation: urbanised areas have fewer fatalities, whereas areas with higher employment density have more bodily injury accidents. But another factor is the level of deprivation in relation to a higher number of casualties (Noland and Quddus, 2004). In a more targeted manner, the relationship between the level of deprivation and pedestrian casualties has been demonstrated (Graham et al., 2005); this effect is strong for children who are victims of road accidents.

Research has more specifically focused on the most deprived neighbourhoods. More generally, accident rates in relation to the population are higher in the most deprived

[1] In the meantime, the definition of accident-related death was increased from 6 days to 30 days in France.

neighbourhoods. For example, Abdalla *et al*. (1997) show that the traffic injury accident rate (per 10000 inhabitants) among the residents of the 15% most deprived areas is nearly twice as high as for the residents of the 15% most affluent areas, in the former Lothian region of Scotland. Edwards *et al*. (2006) show that the pedestrian injury accident rate among the residents of the 10% most deprived areas of London is nearly three times as high as for the residents of the 10% least deprived areas. This excess risk is especially observed among pedestrians, notably children (Preston, 1972; Bagley, 1992; Reimers and Laflamme, 2005; Millot, 2008). Furthermore, the seriousness of pedestrian accidents is greater in deprived neighbourhoods (Roberts and Power, 1996; Edwards et al., 2006).

This excess pedestrian risk can be linked to different characteristics of deprived neighbourhoods. The first concerns the greater mobility among pedestrians within their neighbourhoods (Sonkin et al., 2006), which may have an influence on risk exposure. Macpherson et al. (1998) explain the excess risk among children by their greater exposure to road traffic in deprived neighbourhoods in Montreal. In this latter study, there was a negative correlation between the number of streets that children cross daily and their socioeconomic status.
Other studies based on the socioeconomic characteristics of residents in deprived neighbourhoods have shown excess risks for users other than pedestrians, and these risks may concern a territory larger than the residential neighbourhood itself. Reimers and Laflamme (2005) observed a higher rate of injuries among cyclists and moped riders in areas with weaker social integration (characterised by a large proportion of children under the age of 15, foreign-born people and people receiving social assistance).

More precisely, Zambon and Hasselberg (2006) compared the socioeconomic profiles of young motorcyclists (16-25 years of age) involved in traffic accidents. According to their results, at age 18, motorcyclists from the lowest socioeconomic environments had 2.5 times more risk of being injured than those from more affluent environments.

Murray (1998) studied the family and school conditions of young drivers involved in bodily injury traffic accidents in Sweden, identifying the level of education as one of the essential factors in young drivers' involvement in accidents. For example, young people with little education seem to adopt a riskier lifestyle: they smoke more, drink more alcohol, wear their seatbelts less, etc.

The question that this then raises is that of the origin of the inequalities observed in these deprived areas. What part does people's behaviour play and what part does the area itself play? It is very hard to answer such a question because it is, in practice, impossible to dissociate the urban environment from the characteristics of its residents. The population participates in this environment through the number of vehicles (on the road or parked), the number of pedestrians, the activities performed (commerce in the streets, games, walking, travel), but also the upkeep of equipment (in Lille, teams intervene every morning to fix anything that has been damaged overnight). These specificities in the use made of such spaces, furthermore, mean that they are laid out differently for building features that would seem similar, making it even more difficult to dissociate the factors. It therefore appears impossible to dissociate these factors, no matter what the methodology applied.

The interest of analysing this socio-spatial dimension of road safety, however, indeed lies in the objective of the action. A first question is that of its uniformity throughout the area: are there any spatial characteristics that cause different risks, justifying different actions? A second question is that of sector-based public action: since space-based social renovation actions exist, can we justify combining road safety with such policies, which is not the case today in France? As a corollary, one of the levers for motivating elected officials to act in favour of safety could be the risk for the population, rather than the risk related to a particular area, requiring us to look into the risk of groups of people being involved rather than the risk of accidents occurring in particular areas. That is why this research carried out in the Lille region deals with areas targeted by urban policy and is not interested in the accidents that have occurred there, but rather in those involving the people who live there, no matter where they occur.

But the populations targeted by urban policy may have different levels of risk due to their very spatial situation. Their position within the urban area, the distance to the centre, the density of housing or jobs and the rural or urban character of the environment can lead to different risks (Noland and Quddus, 2004). This factor must be integrated into the approach to answer the previous questions and to provide an estimate of any general excess risk related to the socio-spatial characteristics of populations considered as deprived.

This paper presents research results on the traffic accident risks of residents of deprived areas considered as "sensitive urban areas" in the Lille Metropolitan Urban Community, as compared to the risks of residents of control areas. The possible confounding effect of the geographical situation of these areas is controlled for. The possible effect of demographic differences between the "sensitive urban areas" selected and the control areas is taken into account by carrying out separate analyses by age and sex categories.

2. Method

2.1. Data availability

One of the difficulties in linking data on accidents and data on socioeconomic characteristics comes from gaining access to information. The literature shows the relative diversity of usable sources, but this accessibility always depends on the national situation. What is possible in one country is not necessarily possible in another, as the sources do not exist or access is made difficult for practical reasons or for legal reasons.
There are two main types of access to information. The first uses large national databases dealing with mortality. For example, Roberts and Power (1996) used data from the Office of Population Censuses and Surveys in England and Wales to obtain information on mortality among children by the parents' social class. The authors thus show that socioeconomic inequalities in child injury death rates have increased. Notably, the decline in injury rates of motor vehicle accidents and pedestrian accidents in the manual social classes was smaller than in the non-manual social classes.

In Sweden, detailed data are gathered for all people involved in traffic accidents. A single identifier can then be used to link such data to the general population census and to sources of data on the marks students received when leaving compulsory school. Murray (1998) was thus able to establish links between school levels and involvement in accidents for motorcyclists or bicyclists; Zambon and Hasselberg (2006) showed the close relationship between the socioeconomic differences in the families of young motorcyclists and accident risks.

These studies required statistical databases containing personal information on those involved in traffic accidents.

Such databases do not exist in all countries and access to them often poses legal problems. To get around this difficulty, other researchers use aggregate spatial information. Data on socioeconomic characteristics of inhabitants generally exist on a relatively small spatial scale, usually taken from national censuses. These data are easily accessible. The aim is then to study the proportion of the residents of these small spatial areas that are involved in accidents (whatever the place of occurrence of these accidents — inside or outside the area of residence). This approach requires to know the place of residence of persons involved in accidents. But national accident databases generally do not include the precise addresses of those involved; so it is not possible to pinpoint their place of residence automatically to measure the risk run by the population in a given area. This information is included in the accident reports, but these are often hard to access and take a very long time to analyse to look for those who live in a particular area, given that they may be involved in an accident several kilometres away.

In Great Britain, the postcode of an injured person's address encoded in the STATS19 database makes it possible to pinpoint people precisely and thus to link them to statistical units at the Census Lower Super Output Area Level. This level is sufficiently fine to measure the risks run by the resident populations (Abdalla et al., 1997; Edwards et al., 2006) on the relevant urban area levels.

In France, such data are not available in national accident files, and it is necessary to search information in the police reports (proceedings) themselves. Article 11-1 of the Code of Penal Procedure created by the law dated 9 March 2004 makes it possible to transmit legal proceedings under way for "performing scientific or technical research or inquiries, notably with a view to preventing accidents", to authorities or organisations authorised for such purposes by decree from the Minister of Justice and upon authorisation from the Office of the Public Prosecutor or Investigating Magistrate. This article sets the list of people authorised, including the General Director of INRETS. This provision now enables INRETS to compare data on people involved in accidents and socio-spatial data from population censuses.

2.2 Choice of terrain

The objective of this study was to measure the road risks of residents of deprived neighbourhoods compared with those of residents of other neighbourhoods.

It covered the territory of the Lille Metropolitan Urban Community (LMCU). This Urban Community is located in the Nord département near the Belgian border. It has 1,100,000 residents for an area of 875 km^2. It includes 85 communes. Lille is the central city and has 200,000 residents. The community is multipolar, including Roubaix with 97,000 residents, Tourcoing with 94,000 residents and Villeneuve d'Ascq with 65,000 residents.

Sensitive Urban Areas (ZUSs – Zones Urbaines Sensibles in French) have been stable entities since their creation in 1996 and form the basic units of the orientation and programming law on cities and urban renovation dated 1 August 2003. They constitute the units for defining objectives and monitoring urban policy indicators on the national level. They are characterised by the presence of rundown housing estates or residential neighbourhoods and by a serious imbalance between housing and jobs.

Five ZUSs in the Lille Metropolitan Area were chosen (Map 1). To make comparisons by analysing populations formally subjected to the same kind of urban attractions, contiguous Control Areas were chosen whose populations have more privileged socioeconomic characteristics. Thus, the spatial proximity between the ZUSs and Control Areas enabled us to eliminate the geographical effect leading to differences in mobility due to different distances to central urban areas. On the other hand, the diversity of the ZUS locations in the Lille area enabled us to design procedures to measure risks by controlling the co-factor constituted by these differences in geographical location.

The socioeconomic differences between the ZUSs and Control Areas were verified for each pair studied. For example, there are at least twice as many management-level employees and senior intellectual professions in the Control Areas and twice as many unemployed people in the ZUSs. These analyses are laid out in the report from this study (Fleury et al., 2009)

2.3 Accident data processing

The body of accident reports that the study covers comprises 20,000 accident reports on accidents which occurred in the Nord département from 2001 to 2007 and which were made available to INRETS in digital form. An initial GIS spatial query was used to retrieve all the street names within a given area, then a text query was used to find the reports that the residents were involved in. “Involved” means drivers, passengers and pedestrians. In a later phase, the reports selected were read, validated and then encoded.

The reports drawn up by the police are 15- to 20-page documents in variable formats which give detailed descriptions of bodily injury traffic accidents brought before the courts. The addresses of the people involved are detected automatically but may just as well correspond to an accident site or an insurance address as to a place of residence. Verifying this information and encoding the reports among information supplementing that contained in the statistical files takes time, so processing some one thousand accidents takes approximately 3 months of work by one person. This explains why this research was limited to 5 ZUS-Control Area pairs in the Lille Urban Community.

3. Analysis

3.1 Description of the sample

The accident file produced contains 1,863 people involved in 1,519 accidents. The rate of accidents identified from the use of the database of accident reports drawn up by the police but not recognised in the national statistics records is 1%, both for the ZUSs and for the Control Areas.

There are many more people involved in accidents in the ZUSs as passengers or pedestrians (Table 1). The χ^2 is 21.55, significant at 1%. This is convergent with what is known about the lower use of cars in these neighbourhoods and the greater amount of walking.

On the other hand, the severity of the accidents does not differ much between the different types of areas (Table 2). The χ^2 is not significant.

3.2. Calculation of relative risks and significance testing

For each pair i of areas (ZUS vs. Control Area), the data take the form of a four cell table, where the residence of individuals (ZUS or Control Area) is cross-classified with their involvement in injury accidents (Table 3).

A simple χ^2 test makes it possible to examine the significance of the difference in accident involvement for the residents of a specific ZUS, as compared to the residents of the corresponding Control Area. Regarding the relative risk of accident involvement for ZUS residents, for this pair of areas, the estimate is $RR_i = [a_i/(a_i+b_i)]/[c_i/(c_i+d_i)]$.

Beyond these elementary results, the question is whether, considering the data obtained for the five pairs of areas, there is no effect of the place of residence (ZUS or Control Area), or some effect. In the field of epidemiology, the Mantel-Haenszel χ^2 test is the usual way of testing such "stratified" data (here, the strata are the pairs of areas), controlling for the possible confounding effect of the stratification factor: it makes it possible to test the null hypothesis that the factor studied (ZUS vs. non-ZUS) has *no effect for any stratum* (pair of areas). The Mantel-Haenszel procedure also calculates an overall relative risk (for ZUS residents), the "adjusted relative risk" or adjusted risk ratio, RR_a. This latter calculation assumes the homogeneity of the expected values of the relative risk among the strata, which should be tested (see below). The adjusted relative risk is a weighted mean of the estimates RR_i , taking into account the differences in the variance of these various estimates. For details on this procedure, the reader should refer to handbooks in epidemiology or biostatistics (see for example Jewell, 2004). The Mantel-Haenszel procedure is generally completed by testing the assumption of homogeneity of expected values (of relative risk) among the strata. For this test, the statistic I (Paul and Donner, 1989) can be used:

$$I = \Sigma\ W_i\ [\mathrm{Log}(RR_i) - \mathrm{Log}(RR_a)]^2$$

where the W_i are weights calculated as inverse-variance weights, and RR_a is the Mantel-Haenszel adjusted relative risk. This statistic is distributed as a χ^2 with k–1 degrees of freedom, where k is the number of strata (Paul and Donner, 1989). As a whole, the procedure described here is a means of taking into account the "stratified" nature of the data and a way of controlling for a possible confounding "geographical" effect, corresponding to the various pairs of areas.

3.3 Excess risk among ZUS residents

The analysis will cover the number of residents involved or not involved in each Sensitive Urban Area (ZUS) and in each Control Area. For each area, a risk is calculated as the number of people involved in accidents compared with the total number of residents. The relative risk RR_i is then calculated as a comparison between the risk for ZUS residents and the risk for the Control Area residents (Table 4) for each pair i of areas (ZUS, control).

All the relative risks calculated are significantly greater than 1. The lower limit of the confidence interval for this relative risk is always greater than 1. χ^2 is also always greater than the 5% threshold and in 4 cases than the 1% threshold.

The adjusted relative risk (RR_a) is 1.363, calculated with the Mantel-Haenszel procedure using the information on all of the area pairs studied. It measures the risk that the residents of deprived neighbourhoods run in general compared with the residents of other neighbourhoods. This risk lies within the 95% confidence interval [1.240; 1.502]. The

Mantel-Haenszel χ^2 (39.765) is clearly significant at the 1% level (6.635). The Mantel-Haenszel adjusted relative risk estimate, however, assumes the homogeneity of relative risks across the different strata (pairs of areas). This hypothesis should be examined: It cannot be excluded that the effect may differ depending, for instance, on the location of each pair of areas in the overall spatial structure of the Lille Metropolitan Urban Community territory (which may involve differences in terms of distance to urban facilities, for example).

We then had to look into the homogeneity of these results when going from one pair of areas to another. The effect may differ depending, for instance, on the location of each pair of areas[2] in the overall spatial structure of the Lille Metropolitan Urban Community territory (which may involve differences in terms of distance to urban facilities, for example).

The homogeneity test for relative risks was carried out between the different strata (pairs of areas) with the statistic I: $I = 4.737$, less than the 5% threshold for a χ^2 with 4 degrees of freedom. It is therefore not possible to reject the hypothesis of an absence of interaction, i.e. it is not possible to conclude that there are different effects between the strata.

3.4. Influence of age

Living in a ZUS induces excess risk. But is this excess risk the same for each category of residents? Notably, are there age groups with higher excess risks than others?

To study the influence of age, the same analyses were repeated, but for sub-populations corresponding to age groups [0, 19 years], [20, 39 years], [40 years and over].

For each of these subpopulations, we carried out an analysis using a Mantel-Haenszel procedure in order to calculate the adjusted relative risk on all the pairs of areas and to control for a possible geographical confounding factor, as described in sections 3.1 and 3.2. The results are given in Table 5.

Table 6 shows the value of the adjusted relative risk for all the ZUSs according to the ages of the people who live there. These results suggest that living in a ZUS induces excess risk for people over the age of 20. There is no evidence that this excess risk is heterogeneous across the strata (pairs of areas) considered. This higher level of involvement is also observed for older populations, however, which is an encouragement to look for the reasons in the general characteristics of the deprived areas.

The estimate of the adjusted relative risk for young populations, [0, 19 years] is 1.089, which is relatively low. The Mantel-Haenszel χ^2 is not significant. These results show no evidence of excess risk in ZUS areas for the group [0, 19 years].

The distribution of involvement as a function of the type of travel also differs greatly depending on age (Table7). While the youngest people walk, people between 20 and 39 prefer to drive. These distributions between ZUSs and Control Areas are similar for the young, whereas the differential is higher for those between 20 and 39, with very high automobile use as drivers for the residents of the Control Areas.

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[2] As mentioned in section 2, for each pair, the ZUS area and the matched Control Area are contiguous.

3.5. Influence of gender

Gender can be studied in the same way. Similar analyses were carried out on the male population and then on the female population (Tables 8 and 9).

Calculated as above, the adjusted relative risk assigned to the male population is relatively high, RR_a=1.443. The Mantel-Haenszel χ^2 is highly significant at the 1% level. The tests are much less significant for the female population.

These results suggest that living in a ZUS induces excess risk for both male and female residents, and the relative risk is much higher for the male population.

The individual risks calculated for each area pair may differ, however, and the ZUS of Fives thus presents a greater risk for the female population than for the male population. This type of result encourages us to pursue this analysis, notably by expanding the sample studied.

4. Discussion

This study dealt with the adjusted relative risk of being involved in an accident depending on the place of residence of the person involved. The adjusted relative risk run by those who live in Sensitive Urban Areas (ZUSs) compared with residents of other areas was assessed at 1.366, with confidence interval [1.240; 1.505]. This risk value is significantly different from 1, with a risk of error less than 1%. The homogeneity tests do not suggest a differential effect by pairs of areas studied.

Living in a ZUS leads to a general excess risk. The origin of such an excess risk gives rise to several types of interpretations that the data analysed enable us to discuss.

The first interpretation concerns behaviour, linking the origin of insecurity to attitudes and risk-taking among certain social groups, notably young residents of these neighbourhoods. Analyses of accident reports show certain particular accident processes with hit-and-run offences, refusal to respond police summonses, etc. These incivilities are hard to measure because, in the case of hit-and-run offences, it is sometimes not possible to obtain the person’s address. These behaviours are not marginal; this type of offence is reported in 15% of our body of accident reports. This figure is similar to that found in London in 2004.

In the statistics, this type of behaviour corresponds to higher risk levels, notably for young men. This fact has been studied in the literature (Factor et al., 2008; Van den Bossche et al., 2007; ONISR, 2009). Without going so far as to talk of antisocial behaviours, it is true that research has shown that young people are more willing to take risks than other categories of persons (Hatfield and Fernandes, 2008), more so among men than women (Granié, 2008), leading to types of accidents such as losses of control related to speed and night-time driving (Clarke et al., 2006).

While it is possible to assign part of the risk to incivilities, it is nonetheless true that many accidents are very similar in their processes – or at least in the behaviours involved – to those occurring in the control areas.

A second interpretation would be that the possible differences in mobility in the different types of areas may lead to differences in exposure to risk. Mobility varies with the individuals' social and spatial characteristics in a context of "automobile dependency" (Dupuy, 1999). The different travel practices among individuals are behind new forms of inequalities (Orfeuil, 2004). Access to private cars, for example, is still highly unequal, as they are often inaccessible for tight household budgets.

Several studies in France have shown that the residents of ZUSs are not more "isolated" in their neighbourhoods than the residents of "non-social" neighbourhoods. It nonetheless holds true that there is an over-representation of the least mobile categories in these neighbourhoods. In fact, for the same characteristics (in terms of level of studies, age, etc.), these residents are generally less mobile than elsewhere. They notably travel significantly less in cars (the motorisation rate is still relatively lower in these neighbourhoods), rarely use public transportation and walk more (Harzo and Rosales-Montano, 1995; Coutard et al, 2004; Mignot and Rosales-Montano, 2006).

From this point of view, a larger proportion of walking in the mobility of ZUS residents, for example, could contribute to explain the higher overall traffic accident risk among these inhabitants: according to the review of Elvik and Vaa (2004) the risk of injury for a pedestrian (per person kilometer) is three times to seven times as high as the risk of injury for a car driver or passenger. Table 1, however, shows that, in our data, pedestrians involved in injury accidents represent only a relatively small part of the persons involved (19.6% for ZUS residents and 13.6% for residents of control areas, when all age categories are considered as a whole). Therefore, the qualitative difference in exposure (difference in proportion of walking vs. car use) could only partly explain the difference in accident involvement between ZUS and control areas[3].

The interpretations we have considered here remain partly speculative, and do not exclude other possible explanations of the excess risk of ZUS residents. For example, in reference to the collective learning process which explains the historical trends in road safety (Minter, 1987; Oppe, 1991), we can regard as probable that a (historically) later access to car ownership and use among deprived populations leads to a higher risk, due to a lower level of collective experience of driving and road traffic among these populations. The characteristics of ZUS themselves (in terms of infrastructures and environment) could also play a role, as mentioned in the introduction ; however, some research, based on analyses at the individual or family level, shows that among people residing in the same neighbourhood the risks are higher for individuals of deprived families (see for example Bagley, 1992).

Most of the factors we have evoked to explain the excess risk of ZUS residents can be viewed as consequences of economic or social deprivation. The fact that the excess risk of deprived populations can be identified based on a spatial approach suggests that local measures of economic policy or social policy (for example: measures giving some economic advantages to deprived areas, reinforcement of social work in these areas) could be relevant. But road safety measures applied to these "sensitive" areas, for example in terms of infrastructure treatment,

[3] A more detailed analysis of this point would not be possible without considering the exposure of the different types of road users in terms of distance driven or walked. But this approach poses the problem of the reliability of risk exposure measurements. Mobility measurement by means of transportation is done by sampling throughout the urban territory, but for a given area the number of people surveyed is very small, and the imprecision of the exposure measurement is very large. For this reason, the data available from the Lille Metropolitan Urban Community were not appropriate for such analyses.

could be regarded as a potential remediation approach, even though the excess risk of ZUS residents corresponds to accidents occurred partly outside these areas.

5 Conclusion

Although this study has some limitations, due to the relatively small number of areas studied and to the lack of data on the distances driven or walked by the residents of ZUS and Control Areas, the results clearly suggest that socio-spatial differences have a major effect on accident risk. This effect is not the result of confounding factors related to the geographical location or the demographics of these areas, these factors having been brought under control by the method used. To take these results further, similar analyses will be carried out on other samples from ZUSs and Control Areas in order to work on larger numbers to study the possible influence of urban shapes on these social discrimination phenomena.

The urban dynamics of population aggregation, as much as exclusion, affect where people live, resulting in concentrations in areas with lower property values. The most deprived populations cannot find housing elsewhere. Social policies are implemented to offset the harmful effects of this situation.

The analysis methods used in this study enable us to clearly highlight quantified excess risks in these sensitive areas and to enlighten public decision-making. The challenge is to integrate two public policies – urban policy and road safety policy – into approaches that are both social and spatial. Road safety should then become an integral part of more global social policies, notably those in public health which deal with risk prevention.

Acknowledgements

This research was financed by the Research and Innovation Department of the Ministry of Ecology, Energy, Sustainable Development and Land-Use Planning. The authors would like to thank Thérèse Spector and Fleur Breuillin for their support during the project, the personnel at LMCU, the Lille Metropolitan Urban Community, and notably Jean Louis Séhier and Marc Pouchain, without whom this study would not have been possible, as well as Thierry Saint-Gérand’s team at the University of Caen, who took part in the spatial analysis project on road risks which includes this research. We would also like to thank Marine Millot of the Centre d'Etude de l'Equipement Méditerranée for her unfailing dedication to this study.

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Map 1. ZUSs and Control Areas studied

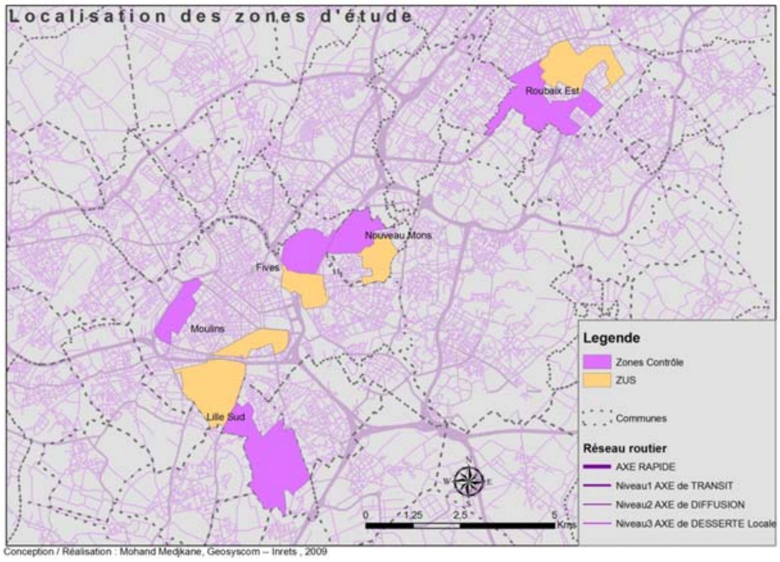

Table 1. Distribution of people involved by means of transportation for all pairs of areas

	Sensitive Urban Areas	Control Areas	Total
Driver	*63.1%*	*73.9%*	*66.6%*
	789	452	1241
Passenger	*17.3%*	*12.6%*	*15.8%*
	217	77	294
Pedestrian	*19.6%*	*13.6%*	*17.6%*
	245	83	328
TOTAL	*100.0%*	*100.0%*	*100.0%*
	1251	612	1863

Table 2. Distribution of people involved by severity for all pairs of areas

	Sensitive Urban Areas	Control Areas	Total
Killed and seriously injured	*24.1%*	*24.7%*	*24.3%*
	237	126	363
Slightly injured and uninjured	*75.9%*	*75.3%*	*75.7%*
	745	385	1130
Total	*100.0%*	*100.0%*	*100.0%*
	982	*511*	*1493**

* The severity is unknown for 370 persons.

Table 3. Form of the data for one pair of areas

	ZUS residents	Control Area residents
Involved in an injury accident	a_i	c_i
Not involved an in injury accident	b_i	d_i

Table 4. Relative risk among residents of ZUSs vs. that of residents of the Control Areas

		ZUS	Control Area	RR_i	C.I.$_{95\%}$ (RR_i) lower limit	C.I.$_{95\%}$ (RR_i) upper limit
Roubaix	Residents involved	534	221	1.226 **	1.049	1.432
	Residents not involved	24,740	12,601			
Mons	Residents involved	147	46	1.395 *	1.003	1.940
	Residents not involved	11,376	4,983			
Fives	Residents involved	129	99	1.408 **	1.086	1.826
	Residents not involved	7,433	8,073			
Moulin	Residents involved	182	123	1.659 **	1.321	2.082
	Residents not involved	10,688	12,062			
Lille South	Residents involved	259	123	1.359 **	1.098	1.682
	Residents not involved	15,795	10,240			

* χ^2 greater than 3.841; 5% threshold
** χ^2 greater than 6.635; 1% threshold

Table 5. Relative risk by age for all pairs of areas

	0 to 19 years			20 to 39 years			40 years and over		
	RR$_i$	Lower limit	Upper limit	*RR*$_i$	Lower limit	Upper limit	*RR*$_i$	Lower limit	Upper limit
Roubaix	0.880	0.646	1.198	1.207	0.946	1.540	1.336 *	1.010	1.767
Mons	1.150	0.596	2.223	1.547	0.895	2.674	1.028	0.582	1.816
Fives	0.944	0.509	1.750	1.307	0.918	1.860	2.056**	1.251	3.379
Moulin	1.890 *	1.043	3.426	2.198**	1.616	2.990	0.909	0.593	1.395
Lille South	1.313	0.839	2.054	1.456 *	1.026	2.066	1.302	0.884	1.917

* χ^2 greater than 3.841; 5% threshold
** χ^2 greater than 6.635; 1% threshold

Table 6. Adjusted relative risk for all the ZUSs by age

	RR$_a$	Lower limit	Upper limit	Mantel-Haenszel χ^2	Interaction test
0 to 19 years	1.089	0.885	1.341	0.852 (ns)	6.040 (ns)
20 to 39 years	1.462	1.263	1.693	26.669 **	9.101 (ns)
40 years and over	1.281	1.074	1.529	7.828 **	6.609 (ns)

ns: not significant
** χ^2 greater than 6.635; 1% threshold

Table7. Distribution of residents of ZUSs and Control Areas involved in accidents by means of transportation and age

	0 to 19 years				20 to 39 years				40 years and over			
	Driver	Psger	Pdest	Total	Driver	Psger	Pdest	Total	Driver	Psger	Pdest	Total
Total	*34%* 147	*24%* 107	*42%* 184	*100%* 438	*80%* 712	*15%* 129	*5%* 48	*100%* 889	*72%* 370	*9%* 47	*18%* 94	*100%* 511
ZUSs	*32%* 98	*23%* 72	*45%* 140	*100%* 310	*77%* 480	*16%* 103	*7%* 42	*100%* 625	*68%* 203	*10%* 31	*21%* 63	*100%* 297
Control Areas	*38%* 49	*27%* 35	*34%* 44	*100%* 128	*88%* 232	*10%* 26	*2%* 6	*100%* 264	*78%* 167	*7%* 16	*14%* 31	*100%* 214
χ^2	4.34 (not significant)				15.27 (significant at 1%)				5.86 (significant at 10%)			

Table 8. Relative risk by gender for all the pairs of areas

	Male population			Female population		
	RR_i	Lower limit	Upper limit	RR_i	Lower limit	Upper limit
Roubaix	1.246*	1.025	1.514	1.132	0.875	1.464
Mons	1.929**	1.231	3.020	0.839	0.507	1.390
Fives	1.240	0.905	1.699	1.711*	1.080	2.710
Moulin	1.975**	1.484	2.628	1.183	0.807	1.735
Lille South	1.453**	1.116	1.892	1.193	0.831	1.712

ns: not significant
* χ^2 greater than 3.841; 5% threshold
** χ^2 greater than 6.635; 1% threshold

Table 9. Adjusted relative risk for all ZUSs by gender

	RR_a	Lower limit	Upper limit	Mantel-Haenszel χ^2	Interaction test
Male Population	1.443	1.278	1.629	36.673 **	9.305 (ns)
Female Population	1.177	1.001	1.383	4.015 (ns)	4.362 (ns)

ns: not significant
** χ^2 greater than 6.635; 1% threshold