Determinants of traffic accident mortality in Italy, 1997-1999

Giuseppe La Torre, Alice Mannocci, Gianluigi Quaranta, Fulvio La Torre

Unità di Epidemiologia e Biostatistica, Istituto d' Igiene, Università Cattolica del Sacro Cuore, Roma, Italy
Correspondence to: Giuseppe La Torre, Unità di Epidemiologia e Biostatistica, Istituto d' Igiene, Università Cattolica del Sacro Cuore, Largo F. Vito 1, 00168 Roma, Italy. E-mail: giuseppe.latorre@rm.unicatt.it

Abstract

Traffic accidents represent an important public health issue in Italy. In order to explore the relationship between traffic accident mortality and factors such as road behaviour, vehicles and road characteristics, four different linear regression models were performed using data from the end of the 1990's provided by the National Institute of Statistics (ISTAT) and from the Automobile Club Italia (ACI). In Italy regional differences in traffic mortality and injury rates can be observed. Strong predictors are the number of motor vehicles circulating and road length (inversely associated) and the number of new vehicles circulating and suspended driving licenses (directly associated).

Key words: traffic accidents, mortality, regional differences, Italy.

Introduction

In the industrialized world mortality from traffic accidents has been decreasing since the early 1970s [1]. In Europe, the greatest reduction was seen between 1970-1980. Despite these improvements, however, road casualties, whether fatalities or injuries, still represent an important public health issue; it has been calculated that in the European Union (EU) 1,300,000 accidents occur each year, causing 1,700,000 injuries/year and over 40,000 deaths/year. In addition to the incalculable human cost, traffic accidents have cost society 160 billion Euros, 2% of the EU GNP [2].

Furthermore, traffic accidents are a leading cause of death and disability in children and young people [3-5] and are the main cause of death in those under 45 years of age [2].

In Italy, around 270,000 road traffic accidents occur annually, causing almost 7,000 deaths [6].

According to the scientific literature, considerable differences are present amongst countries and, in some of these countries large regional differences in traffic accident mortality may be present; these differences seem to be correlated to socio-demographic factors and to specific factors such as road behaviour, infrastructural road safety measures, as well as the accessibility and quality of medical care [1,7].

The purpose of the present study is to discover the strongest determinants of traffic mortality rate, injured people rate, traffic accident rate, case-fatality rate; in particular, analyses will be performed to determine to what extent the differences – where they exist – in traffic accident mortality can be explained by the regional differences in traffic mobility, with injury rate and case-fatality (number of deaths/number of injured people); furthermore, it will be discussed which relation can be observed between the outcomes selected and factors describing vehicles and road characteristics.

Materials and methods

We used data from National Institute of Statistics (ISTAT) [8] and from the Automobile Club Italia (ACI) [9] relating to the end of the 1990's. It is important to underline that data available regarding traffic accident are only the ones related to the recorded crashes. An analysis was conducted of the contribution of regional differences in traffic mortality rate (number of deaths / resident population per 100,000), injury rate (number of injured people / resident population per 100,000), traffic accident rate (number of accidents / resident population per 100,000) and case-fatality (calculated as traffic deaths/injured people). Factors directly linked to traffic deaths, and road related factors (number of motor vehicles circulating, number of new vehicles circulating, pro-capita fuel consumption, road length, suspended driving licences) were used in linear regression models. For the statistical analysis SPSS 12.0 for Windows was used; different multiple linear regression models were performed, using the backward elimination procedure. The fitness of the model was estimated using the statistic R. The statistical significance was set at $p < 0.05$.

Figure 1. Regional differences in traffic mortality rates (number of people dead for traffic accident / resident population per 100,000) in Italy, 1997-1999.

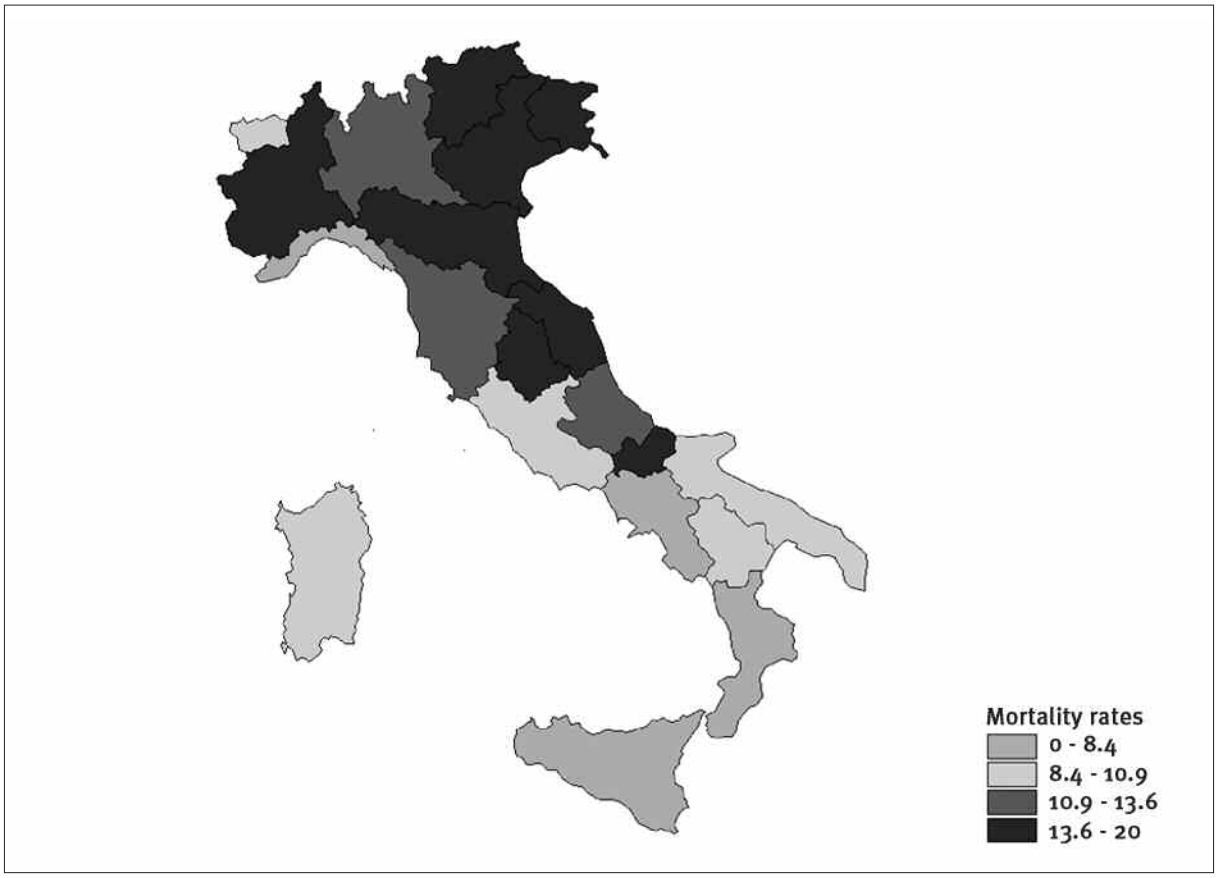

Table 1. Multiple regressions of traffic mortality rate, injured people rate, traffic accident rate and case-fatality rate.

	Traffic mortality rate		Injured people rate		Traffic accident rate		Case-fatality rate	
	Beta	p	Beta	p	Beta	p	Beta	p
Number of motor vehicles circulating	-1.825	0.006	-1.73	0.006	-0.233	0.516	-0.151	0.747
Number of new vehicles circulating	1.894	0.005	1.475	0.026	0.718	0.872	0.893	0.742
Suspended driving licences	-0.204	0.594	0.593	0.049	0.858	0.001	-0.303	0.166
Road length	0.415	0.195	-0.694	0.004	-0.712	0.003	-0.274	0.289
Pro-capita fuel consumption	-0.067	0.775	0.287	0.184	0.270	0.182	-0.426	0.048
R of the Model	0.617		0.728		0.722		0.426	

Results

In Italy, traffic mortality and injury rates are higher in the Northern Regions with a clear North-South gradient (Figure 1).

The results of the four linear regression models performed are showed in Table 1. Factors significantly associated to traffic mortality rate (R of the model = 0.617) are the number of motor vehicles circulating (β = - 1.825; p = 0.006) and the number of new vehicles circulating (β = 1.894; p = 0.005).

The number of motor vehicles circulating (β = - 1.730; p = 0.006), the number of new vehicles circulating (β = 1.475; p = 0.026) and suspended driving licences (β = 0.593; p = 0.049) are significantly associated to injury rate (R = 0.728).

Factors significantly associated to traffic accident rate (R = 0.722) are road length (β = - 0.712; p = 0.003) and suspended driving licences (β = 0.858; p = 0.001).

The only factor significantly associated to case-fatality (R = 0.426) is pro-capita fuel consumption (β = - 0.426; p = 0.048).

Discussion

In Italy regional differences in traffic mortality and injury rates can be observed. This result is consistent with the few existing studies about the

regional differences in traffic accident mortality actually available [1,7]. It is possible to observe that traffic mortality (Figure 1) and injury rates in Italy are higher in the Northern Regions with a clear North-South gradient; case-fatality rate does not show regional differences.

Factors that are associated significantly to traffic mortality rate and injured people rate are the number of motor vehicles circulating (inversely associated) and the number of new vehicles circulating (directly associated). The relation between mortality and the number of motor vehicles circulating is probably explainable considering that, where the number of motor vehicles is higher, the travel speed is lower, so the probability of injury is reduced and the traffic accidents that occur are less severe. With regards to the direct association between the number of new vehicles circulating and both traffic mortality rate and injured people rate, it is possible to suppose that people driving new vehicles are more confident in the safety measures and protective equipment of their new vehicles (for example, airbags, modern electronic devices for the control of the efficiency of the brakes), so they feel are somewhat free to drive in a more sporting like manner and to travel at speeds, resulting in more traffic injuries, more of which are severe.

The number of suspended driving licenses are directly correlated to the rate of injured people and to the traffic accident rate, probably because it is related to road behaviour and whether or not people respect the road rules (e.g. speed limit, blood alcohol level, blood drug level).

The road length is inversely associated to the traffic accident rate. Pro-capita fuel consumption shows an inverse relationship with case-fatality rate. It is not easy trying to interpret these results; probably further approaches with multiple linear regression models using more covariates related to the road's infrastructure, the different typologies of roads, the cultural and economic factors and the roads behaviour could be useful to understand the roles of the strong predictors of these covariates.

The analyses reported have some limitations. An important possible source of bias is the so-called omitted-variable problem, which arises when a study does not account for all explanatory variables [1]. In our study it was not possible to collect data at the regional level regarding some road behaviours: seat-belt use and the use of crash-helmets for two-wheel motor vehicles, travel speed and so on. These might be important explanatory variables whose effects can be seen through the differences in injury severity [1]. Moreover, in our linear regression models, using injured people rate and traffic accident rate as dependent variables respectively, we interpreted the number of suspended driving licenses as a proxy of road behaviour, but we cannot exclude that a fraction of the total number of suspended driving licences could be the consequence of traffic accidents. For all of these reasons the results of this study must be interpreted with care. Further studies over a longer time-period analysing and examining the role of more explanatory factors could be useful in order to understand the determinants of traffic accident mortality in our country and to discover the high risk areas, so as to implement effective measures in order to prevent these avoidable fatalities.

References

1) Van Beek EF, Mackenbach JP, Looman CW, Kunst AE. Determinants of traffic accident mortality in the Netherlands: a geographical analysis. Int J Epid 1991; 20:698-706.

2) European Commission. Directorate-General for Energy and Transport. MEMO. Halving the number of road accident victims in the EU by 2010: a shared responsibility. Brussels: Directorate-General for Energy and Transport; 2003.

3) Hjern A, Bremberg S. Social aetiology of violent deaths in Swedish children and youth. J Epidemiol Community Health 2002;56:688-92.

4) Sethi D, Racioppi F. Road traffic injury prevention in children and youth in the European Region. Eur J Public Health 2004;14(4 Suppl):39.

5) Maffei De Andrade S, Soares DA, Pereira Braga G, Herrero Moreira J, Nardo Botelho FM. Comportamentos de risco para acidentes de transito: um inquerito entre estudantes de medicina na regiao sul do Brasil. (Risky behaviour for traffic accidents: a survey among medical students in southern Brazil). Rev Assoc Med Bras 2003;49 (4): 439-44.

6) La Torre G, Mannocci A, Pinnarelli L, Marano C. Determinants of traffic accident mortality in Italy. Eur J Public Health 2004;14(4 Suppl): 39.

7) Baker SP, Whitfield MA, O'Neill B. Geographic variations in mortality from motor vehicle crashes. N Engl J Med 1987;22:1384-7.

8) ISTAT. Statistica degli incidenti stradali - Anno 1999. (National Institute of Statistics. Statistics of crash accidents - Year 1999). Roma: Istat, 2000.

9) ACI, Automobile Club Italia – www.aci.it