Injuries are a major cause of death and disability, road traffic injuries being the ninth leading cause of worldwide disability adjusted life years, and in 2020 it is expected to be the sixth. However, the injury burden is not shared equally among all groups in society, with inequalities by socioeconomic position, the less privileged groups suffering higher rates of mortality and morbidity. Studies have examined such impact from the point of view of socioeconomic inequalities in health and in traffic injuries are important for reasons of fairness and social justice, and because targeting or tailoring injury prevention measures towards disadvantaged groups may increase the overall effectiveness of these measures. However, recent reports on traffic injuries have not highlighted the issue of socioeconomic inequalities in injuries.

Although the study of social inequalities in health has been broadened since the 1980s, inequalities in injuries have been studied somewhat less, and most studies, mainly of traffic injuries, have focused on children and the young. These studies show the existence of socioeconomic inequalities in injury mortality and morbidity, with less privileged children showing higher injury rates. Fewer studies have been done describing socioeconomic inequalities in mortality by injuries, and transportation/traffic injuries, in middle age and the elderly.

Despite the increasing attention placed on the need to reduce the impact of motor vehicle injuries in Europe, no studies have examined such impact from the point of view of social inequalities in the European context. The objective of this paper is to study the differential distribution of transportation injury mortality by educational level in nine European settings, among middle aged and elderly men and women during the 1990s.

METHODS
We studied the population older than 30 years living in nine European settings. We used mortality data from an international study ("Socioeconomic determinants of healthy ageing: From description to explanation", SedHA Study). Specifically, data from national, regional, and urban longitudinal mortality studies were used, based on the linkage between mortality registries and census data. We studied Austria, Belgium, Denmark, Finland, Norway, and Switzerland, the region of Madrid (Spain) and the cities of Turin (Italy) and Barcelona (Spain). For Switzerland we only included the population living in the German speaking parts of the country. The data refer to different settings (countries, regions, and cities) due to the availability of information in each country. In this study, we included cases of death older than 30 years from traffic injuries and other transport injuries (codes of the International Classification of Diseases (ICD)-8 revision: E800-E845 and E940-E941; ICD-9 codes E800-E848, E929.0, and E929.1, and ICD-10 codes V01-V99, Y85.0, and Y85.9) of residents in each of the participant countries or regions during the 1990s. The ICD codes chosen in the SedHA Study were the ones that played a major role in explaining inequalities in mortality among the
elderly. For Denmark we only included people up to 69 years because we did not have data for older age groups.

The data were aggregated by five year age group (age specified at the start of the follow up), sex, and level of education. Person years at risk were obtained from the appropriate censuses.

As a measure of socioeconomic status, educational level of each deceased was used. It was obtained from the census and was coded initially according to national education classifications. We reclassified these into three categories (low, middle, and high), that corresponded approximately with levels 0–2 (pre-primary, primary, and lower secondary education), 3 (upper secondary education), and 4–6 (post-secondary education) of the UNESCO Standard Classification scheme respectively. This reclassification is based on the relative position of the educational levels in the population and it resulted in a distribution of educational levels over the population that was similar and comparable across countries. In the calculation of rate differences and rate ratios, we used the combined levels of middle and high education as the reference group. These levels were combined because in some settings the proportion of highly educated (the reference group) was too small in some age groups to perform robust analyses.

Table 1 (see http://www.injuryprevention.com/supplemental) shows the distribution of person years by educational level. For Switzerland applying the general classification proved difficult, as is apparent from deviating distribution over the population. Table 1 also shows the percentage of death records where the educational level was missing, which was most important in Barcelona (more or less 30%) but also large in Madrid, Denmark, and Belgium (between 8% and 17%). These percentages were similar for males and females. These deaths were not excluded from the calculation of total mortality transportation rates, but they had to be excluded from the educational level rates.

![Figure 1](http://injuryprevention.bmj.com) Standardized mortality rates per 100 000 person years by educational level (three groups) by setting and sex. Transportation injuries mortality, >30 years old. Data for Denmark refers to up to 69 years of age. Switzerland only includes German speaking parts. “All settings” excludes Denmark.

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**Table 2** Number of deaths (n), rates per 100 000 person years (rate) and rate difference (RD) (low minus middle/high level of education) by setting, age group, and sex. Transportation injuries mortality, >30 years old

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**Notes:**

- “n” and “Rate” include deaths and person years with missing data on educational level.
- Data for Denmark refers to up to 69 years of age.
- German speaking parts of Switzerland.
- Excludes Denmark.
Age standardised rates for each of the three educational levels in each setting were calculated by the direct method using as standard the European population. Mortality rates by age group (30–49, 50–69, ≥70) and sex were obtained for each setting. For Denmark all these analyses were obtained only for people younger than 70 years of age.

We created a pooled dataset with the data of all settings, including setting specific weights assigned to the individual observations, so that the separate populations contributed equally in the results for all populations combined. The dataset included all settings with the exception of Denmark (because of missing data for older people).

Absolute educational mortality inequalities were expressed as rate differences for each setting and sex. Rate ratios (RR) were also determined for the same groups through Poisson regression models in order to study relative inequalities in mortality. We used SPSS (SPSS Inc, Chicago, IL, USA) and Egret statistical packages (Egret, Cytel Software Corp, 1999).

### RESULTS

Transportation injuries death rates increased with age and in men were higher than in women (table 2). For men as well as for women, Finland, Belgium, and Austria had the highest death rates.

Figure 1 shows the age standardized death rates among the three educational levels in males and females in each setting and in all settings together. In men, those with a low educational level had higher death rates in all settings (death rate of 20.3 per 100 000 inhabitants, compared with a rate of 12.3 in the high level education), a pattern that was maintained in the different settings although in Madrid the differences were very small. Inequalities were most important in Finland, where the death rate of 31.1 per 100 000 inhabitants among men of low educational level contrasts with 16.5 among men of high educational level. There were no significant differences in women (death rates around six per 100 000 inhabitants in the three levels of education) and in some countries a reverse pattern was observed, for example in Norway where high educational levels had higher rates (7.1 per 100 000 inhabitants among women with a high level of education and 4.1 with a low level).

Differences between rates in the two groups of educational level by setting, age group, and sex are shown in table 2. For all the settings the differences are around five per 100 000 inhabitants in males, increasing in the elderly, and they are small in females. In the different settings, for men, the biggest differences are found in Finland, Switzerland, and Austria, whereas for women the differences are very small and for the oldest group, the majority of differences are negative.

Rate ratios by country, age group, and sex are presented in table 3. Among men, in all the settings, the RR was higher in the 30–49 age group (RR 1.46, 95% CI 1.32 to 1.61) than in the other age groups. In the youngest group, the majority of RR of the different settings were higher than 1 and statistically significant, except for the region and cities of the South of Europe. In the 50–69 age group for males it is worth mentioning the highest rate ratios for Switzerland (RR 2.11, 95% CI 1.66 to 2.68) and Austria (RR 1.85, 95% CI 1.16 to 2.96). In the oldest age group the RR were lower.

For women in all the settings together, no differences were found among educational levels in the three age groups. In the different settings, only three had a high RR in the youngest age group, Finland (RR 1.33, 95% CI 1.01 to 1.74), Belgium (RR 1.38, 95% CI 1.13 to 1.67), and Austria (RR 1.49, 95% CI 0.75 to 2.96), while in Norway women older than 50 years had a statistically significant RR under 1 (table 3).

### DISCUSSION

This study is the first attempt to compare the differential impact of transportation/traffic fatalities by education among different European settings. The results indicate that educational inequalities were more important in younger adult males (age 30–49 years). On the contrary, female transportation/traffic mortality showed no inequalities in the majority of settings, with a reversed trend in the oldest age group in some settings.
A conceptual framework has been proposed for studying the impact on injury of socioeconomic level and social context. At an individual level, two mechanisms may be involved in the relation between socioeconomic level and injury: differential exposure (for example, different use of protective devices by people of different socioeconomic level) and differential susceptibility. The influences of the social context may have an impact on socioeconomic level, differential exposure, differential susceptibility and directly on injury. In this paper, we have been able to measure socioeconomic level through educational level and also contextual influences by means of the different national contexts.

The differences found in the transportation/traffic mortality rates in the various settings are worthy of comment. Although it has been reported previously, in national statistics, that southern European countries have higher traffic injury death rates than the majority of central and northern countries, in this study the rates for settings in the south of Europe are the lowest. We believe that this is at least partly because these data come from urban areas (Madrid, Turin, and Barcelona), where traffic exposure patterns are somewhat different. Injury severity tends to be lower in urban areas, where traffic crashes tend to be at a lower speed and therefore the resulting impact tends to be less harmful, possibly contributing to lower overall rates and smaller educational differences. However, it is uncertain whether and how this fact would affect the comparability of relative inequalities among the different settings. Moreover, it has to be mentioned that Switzerland only included German speaking population.

Another study has described how economic development of a country is related to traffic mortality: it first leads to a growing number of traffic deaths but later becomes protective, although some countries do not clearly follow this pattern, such as Spain and Greece, where no decrease in traffic deaths was found. However, this study did not focus on socioeconomic inequalities in health.

The interpretation of the differential impact of transportation/traffic mortality by educational level needs to account for the differential exposure to traffic of people of different educational levels, a feature that the study could not cover due to the lack of information on exposure levels, such as number of vehicles, kilometers driven, and so on. Although there is evidence indicating that exposure to traffic tends to be higher in men and in the young and middle age population. However, this study did not focus on socioeconomic inequalities in health.

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socioeconomic groups. As an example of post-crash strategies we should mention the improvement of access to care and to rehabilitation services to the whole population, including the disadvantaged groups.26

ACKNOWLEDGEMENTS

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T Valkonen, Department of Sociology, University of Helsinki, Helsinki, Finland

REFERENCES


New Zealand drowning report

A recent report, Circumstances surrounding drowning in those under 25 years in New Zealand (1980–2002), from New Zealand’s Child and Youth Mortality Review Committee in collaboration with Water Safety NZ reveals that there has been a significant reduction in the incidence of drowning related deaths (p<0.001). The study reviewed the 1334 drowning related deaths over the 23 year study period. It identified that the areas needing further attention are pre-school drownings and drownings of males aged 15–19. The authors also emphasise the need to enforce pool fencing legislation and to increase water safety education. For further information, contact Professor Barry Taylor, Professor of Paediatrics and Child Health, at the Dunedin School of Medicine, email: barry.taylor@stonebow.otago.ac.nz.
Education level inequalities and transportation injury mortality in the middle aged and elderly in European settings

C Borrell, A Plasència, M Huisman, G Costa, A Kunst, O Andersen, M Bopp, J-K Borgan, P Deboosere, M Glickman, S Gadeyne, C Minder, E Regidor, T Spadea, T Valkonen and J P Mackenbach

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