Human and environmental factors contributing to fatal road accidents in a Romanian population

Petre Liviu Munteanu,1* Mariana Roșu,2 Viorel Panaitescu,3 Antoaneta Pungă4

Abstract: Road accidents are often caused by an accumulation of elements which belong largely to four major classes of conditions: the human factor, infrastructure, vehicles and weather conditions. In Romania the number of fatal road accidents per capita is among the highest in Europe. In order to limit the number of directly fatal road accidents, it is essential to know the contributing factors that lead to their increase. The purpose of this study is to synthetically analyze the conditions related to human and environmental factors that contribute to directly fatal road accidents on a representative sample of cases. Our study has identified as major risk factors for fatal road accidents: male gender, age between 30 and 39 years old, low educational level, darkness, inattention, excessive speed while driving. Therefore the main risk factors for fatal road accidents are similar to those in other countries. The large number of cases (positioning us on the first three places in the EU, together with Lithuania and Croatia) may be decreased by implementing protective measures similar to those in other EU countries, which have been shown to significantly decrease the number of fatal road accidents.

Key Words: road accidents, Buzau, weather conditions, climatic factors.

Road accidents are often caused by an accumulation of elements which belong largely to four major classes of conditions: the human factor, infrastructure, vehicles and weather conditions. In Romania the number of fatal road accidents per capita is among the highest in Europe. In order to limit the number of directly fatal road accidents, it is essential to know the contributing factors that lead to their increase.

MATERIALS AND METHODS

The study is based on cases obtained within the Forensic Service Buzau and includes 339 cases selected during the period of 2005-2009. This is a retrospective, archival study, based on forensic reports of the body (autopsies). Among the possible climatic factors involved in road accidents we analyzed: the presence of wet roads, winter conditions, fog, and darkness. Among the human factors associated with fatal traffic accidents in our study we analyzed: inadequate speed, ethanol intoxication, inattention, incorrect pedestrians' movements, fatigue etc.

The data were entered in a SPSS type database and were analyzed with the SPSS v20 software. We used descriptive statistics (averages, medians, standard deviations), the Chi2 test for the analysis of the associations among qualitative variables, the Spearman test for the correlation analysis of the semi-quantitative variables and logistic binomial regression analysis to identify the chance rate.
RESULTS

Human factors

In the study group 338 patients were included, out of which 80 (24%) were female and 258 (76%) were male. The most affected age group was of 30 to 39 years old, among whom 66 patients were identified (19.58%). The age groups of 20-29 years old (54 cases, 16.02%), 40-49 years old (51 cases, 15.3%) and 50-59 years old (57 cases, 16.91%) had a similar prevalence. Somewhat lower values were identified in the groups of 60-69 years old (34 cases, 10.09%) and of over 70 years old (43 cases, 12.76%). The higher value obtained for the age group of over 70 years old compared to the 60-69 years old is explained by the increase in the age range. The lowest number of cases is found in people under 20 years old (less than 10% in total), as they do not have a driving license and so they do not drive cars. The age distribution is not Gaussian; there are significant variations in our cases compared to theoretical ones (the Kolmogorov-Smirnov test for a variable has a value of 0.132, p<0.0001). The average theoretical age is 39.08 years old, the distribution being slightly leptokurtic (-0.815). By analyzing the distribution of cases by age and gender groups it follows that males involved in fatal traffic accidents were predominantly middle-aged, while at extreme ages (especially 20 years old, but also over 60 years old) the percentage of females involved is higher. The association between age and age groups is statistically significant (the Pearson Chi2 test has a value of 15.773, significant at p=0.027).

Ethanol intoxication was identified in 8 cases. However, the value is most likely greatly underestimated as many victims were hospitalized, which means that the alcohol level could not be calculated postmortem.

Incorrect pedestrian placement was identified in four cases. Due to the extremely small number of cases we could not establish any correlation with other factors. Similarly, fatigue was identified in only nine cases, and as such statistical associations could not be made.

Inattention, both while driving and on the part of the other traffic participants, was extremely frequently identified (143 cases, 42%). The age group most "affected" by this is of 50-59 years old. However, the differences between the age groups are not statistically significant (Pearson Chi2=11.296, p=0.126). Inattention was identified less times in pedestrians (44 cases out of 105, 42%) than in drivers (51 cases of 80, 64%). The associations between the two variables are statistically significant (Pearson Chi2=24.845, p<0.0001). NB: In the case of the car passengers, inattention was quantified in relation to the driver’s. Inattention is strongly associated with darkness; out of the 94 cases in which the latter was incriminated, in 60 it was associated with inattention (Pearson Chi2=24.99, p<0.0001) and with inadequate speed, present in 38 cases out of 59 (Pearson Chi2=14.446, p<0.0001).

Other reported human factors were: lack of skill, travelling on roads where that vehicle was prohibited (carts), cutting off other vehicles, failure to signal the cart, lack of experience, failure to observe traffic rules.

Inadequate speed was identified in 59 cases (17%). There is no association between the sex of the victim and inappropriate speed (Pearson Chi2=0.106, p=0.445). The most prone to this risk factor are those who are 20-29 years old, the age group in which 24 cases were identified, that is 41% of the cases in which this risk factor was identified and 44% of the fatal accidents in this age group. The association is extremely strong (Pearson Chi2=43.938, p<0.0001). Among the categories of traffic participants, the drivers are most often the victims in situations where there is inadequate speeding (Pearson Chi2=57.609, p<0.0001).

Table 1. Age group distribution for the inadequate speed parameter

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Inadequate speed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>0 - 9 years</td>
<td>14</td>
</tr>
<tr>
<td>10 - 19 years</td>
<td>13</td>
</tr>
<tr>
<td>20 - 29 years</td>
<td>30</td>
</tr>
<tr>
<td>30 - 39 years</td>
<td>53</td>
</tr>
<tr>
<td>40 - 49 years</td>
<td>49</td>
</tr>
<tr>
<td>50 - 59 years</td>
<td>46</td>
</tr>
<tr>
<td>60 - 69 years</td>
<td>33</td>
</tr>
<tr>
<td>over 70</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>278</td>
</tr>
</tbody>
</table>

Climatic factors

Wet roads were identified as a contributing factor in 12 cases. One cannot establish correlations or associations between the presence of wet roads and
age, sex, and the type of accident. As a percentage, the highest number of cases where wet roads led to death is present with drivers, but the association is not statistically significant (Pearson Chi²=6.506, p=0.591).

Fog was identified as a contributing factor in five cases. One cannot establish correlations or associations between the presence of wet roads and age, sex, and the type of accident.

Winter conditions were identified as contributing factors in four cases. One cannot establish correlations or associations between the presence of slippery roads (winter conditions) and age, sex, and the type of accident. Darkness was identified as a contributing factor in 94 cases. Females were significantly less involved in fatal road accidents where darkness was considered to be a contributing factor (Pearson Chi²=21.419, p=0.006). The association between dark and inadequate speed is also strong, suggesting an increased risk in circumstances where there is this combination (Pearson Chi²=7.644, p=0.006).

DISCUSSIONS

Our study revealed a predominance of fatal road accidents in 30 to 39 years old males. These data are consistent with those from specialist literature[16-19], and the identified causes were represented by the increased time spent in a vehicle compared to other population groups, the increased speed, alcohol consumption, etc. [14]. Among personal factors, the most important were considered to be hostility and changes in self-esteem [20]. The study by Mizell identified the main factors that lead to increased traffic aggression as low age, low educational level, a criminal record, a personal history of violence or alcohol consumption [20]. Out of these, our study could only quantify the age and educational level. The analysis of the latter reveals that most people involved in fatal accidents had basic education (secondary school) or middle level education (high school, vocational school, mid high school). The number of people with higher education involved in road accidents is much lower. Possible causes for this distribution are:

- the reduced number of people with higher education in Romania
- the high number of people with middle level education who are professional drivers
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The first hypothesis is supported by the analysis of the distribution of subjects in relation to the educational level and the age group. It thus appears that in people who are 20-40 years old the most affected are those with a high school education; this result is generated by the fact that high school is virtually mandatory, and the number of people who drop out of high school is very low. In the age group of 50-70 years old, most victims had a secondary education, as in that period primary and secondary school were mandatory. In the age group of over 70 years old, most victims have primary education, as in that period primary education was mandatory. The association is extremely strong (the Pearson Chi² test has a value of 527.717, significant at p<0.0001). Therefore it can be concluded that the people most often involved in fatal road accidents have the minimum level of mandatory education.

Another extremely important driving issue, with frequently fatal consequences, is the driving error, quantified in our study by three variables, namely inattention (of the driver), speeding and incorrect placement of the pedestrian. Inattention was extremely common in our study group, a finding again consistent with specialist literature [21-23]. This risk factor is worldwide accepted as an extremely important risk factor, difficult to prevent at the driver's level; this caused a boom in car safety systems that would mitigate the effects of reckless driving - from systems that brake automatically, to systems related to the lane, or which identify pedestrians, cyclists, traffic signs and so on.

Among the climatic factors the most frequent one was darkness, which was identified in 94 cases, especially in male pedestrians. With regard to darkness, the results are consistent with specialist literature [24, 25]. For example Druker et al have shown that driving at night is associated with an increased risk of fatal and non-fatal accidents (OR = 2.8 and 1.6); the risk increases if the roads do not have proper lights.

CONCLUSIONS

Our study shows that the main risk factors for fatal road accidents are similar to those in other countries. Therefore the large number of cases (positioning us on the first three places in the EU, together with Lithuania and Croatia) may be decreased by implementing protective measures similar to those in other EU countries, which have been shown to significantly decrease the number of fatal road accidents.


