Rev Saúde Pública 2011;45(4)

**Andréa Fernandes Magalhães**[I]

**Creso Machado Lopes**[I]

**Rosalina Jorge Koifman**[II]

**Pascoal Torres Muniz**[I]

# Prevalence of self-reported traffic accidents in Rio Branco, Northern Brazil

## ABSTRACT

**OBJECTIVE:** To estimate the prevalence of self-reported traffic accidents and identify associated factors.

**METHODS:** Cross-sectional, population-based study carried out from September 2007 to August 2008, in the urban and rural zones of Rio Branco (Northern Brazil). Data referring to adults (aged 18 to 96 years, n = 1,516) of the inquiry Health and Nutrition of Adults and Children of Rio Branco, obtained in home interviews, were analyzed. The relations between self-reported traffic accident and socioeconomic and behavior variables were analyzed by means of prevalence ratios and 95% confidence intervals; Poisson regression analysis was performed.

**RESULTS:** The prevalence of self-reported traffic accident was 36%. In the Poisson analysis, male individuals (PR= 1.45 and 95% CI: 1.12;1.87) who reported alcohol consumption (PR= 1.25 and 95%CI: 0.97;1.62), with income above five minimum wages (PR= 1.88 and 95%CI: 1.25;2.83), aged between 18 and 25 years (PR= 1.45 and 95%CI: 1.02;2.05), presented higher probability of reporting involvement in traffic accidents. The variables age and level of schooling had inverse association with the outcome, while income had a positive association, all of them with significant tendency.

**CONCLUSIONS:** The prevalence of self-reported traffic accidents shows higher risk for men with higher income, lower level of schooling and who ingest alcoholic beverages. They should be the target of prevention campaigns.

**DESCRIPTORS: Accidents, Traffic. Prevalence. Rural Zones. Urban Zones. Cross-Sectional Studies.**

## INTRODUCTION

Traffic accidents (TA) may have important social and economic implications, among others, especially in the developing countries, in view of the change in the morbidity and mortality profile in these nations. TA are relevant as they predominate in young and economically active populations, imposing high costs on the health and social security systems.[2]

In Brazil, 10.6 billions of reais were spent on TA in 2003, including the several losses that they cause: production loss, damages to vehicles, rescue of the victims, judicial proceedings, medical treatment of the victims, among others.[a] The external causes were responsible for 127,470 deaths registered in *Sistema de Informação sobre Mortalidade* (SIM - Mortality Information System) in

[a] Instituto de Pesquisa Econômica Aplicada. Agência Nacional de Transportes Públicos. Impactos sociais e econômicos dos acidentes de trânsito nas aglomerações urbanas: síntese da pesquisa. Brasília; 2003.

[I] Departamento de Ciências da Saúde e do Desporto. Universidade Federal do Acre. Rio Branco, AC, Brasil

[II] Fundação Oswaldo Cruz. Rio de Janeiro, RJ, Brasil

**Correspondence:**
Andréa Fernandes Magalhães
UFAC Campus Universitário, Km 4
CCSD
Distrito Industrial
Caixa Postal 500
69915-000 Rio Branco, AC, Brasil
E-mail: afmaga@ig.com.br

Received: 7/25/2010
Approved: 1/19/2011

Article available from: www.scielo.br/rsp

2006, among which 84% corresponded to men. Land TA was the second cause of death by external causes, representing 28% of this total. It ranks behind only aggressions.[b]

Economic development is one of the important factors that determine the alteration of mortality and disease patterns, even though there is large disparity between societies concerning the tendency of mortality caused by traffic accidents.[14]

The developing countries, which are in transition to motor transport, reach a peak of mortality by accidents involving vehicles before achieving lower rates like the ones observed in more developed regions.[14] This change is not shared by all social strata, and the highest mortality by accidents affects mainly the most vulnerable users of the traffic system, the cyclists and pedestrians, who generally belong to the least favored social classes and walk long stretches or use the bicycle as a means of transport. This situation coexists with an emerging middle class that uses private motor vehicles.[11]

Alcohol consumption is positively associated with high occurrence of TA. Epidemiological studies in the United States indicate that alcohol is the main factor in the occurrence of TA and that when they involve drivers with blood alcohol content above 0.8 g/l, there is a higher chance of resulting in death and lesions.[7] Besides, the relative risk of involvement in fatal TA rises proportionally to the increase in blood alcohol content, for all groups divided by sex and age.[15] Thus, drivers with blood alcohol content above 0.1% put themselves and the other users of public roads in high risk of TA.[15]

The prevalence of reported consumption of any amount of alcohol in the total Brazilian population is 68.7%. The prevalence of alcohol dependence is higher in the North region, where it exceeds 16%, in contrast with the South Region, with 9.2%.[6]

Data about blood alcohol content in non-fatal accidents are scarce in Brazil, as the legislation determines the performance of the blood alcohol content test only in TA with fatal victims. Even so, a research in Belo Horizonte (Southeast of Brazil) using a breathalyzer accused that 19.6% of the drivers presented blood alcohol content levels equal to or above 0.6 g/l (the limit established by the law that was in force at that time[c]) and 18.4% presented some level of alcohol in the exhaled air, resulting in 38.0% of drivers who drove with some level of alcohol in the blood.[3]

Other factors are also associated with traffic accidents, such as education and knowledge about the legislation and enforcement of traffic laws. To the young population, mainly youths who have recently been licensed to drive, traffic education is an indicator that favors the decrease in the occurrence of collisions.[11,16] Mortality by TA decreased more in the South and Southeast of Brazil with the enforcement of the Brazilian Traffic Code and, in these regions, the population has an educational level that is higher than in the North Region.[13]

Mello Jorge showed in 1994 that the variation in the rates of mortality caused by TA in the different regions of Brazil is influenced by migration flows, urbanization histories, cultural peculiarities and unequal socioeconomic patterns.[9]

The regional risk factors of TA are important to guide preventive actions and the investment of available resources. The existence of population-based studies about non-fatal TA in Rio Branco (Northern Brazil) is unknown. Thus, the present study aimed to estimate the prevalence of TA and identify associated factors.

## METHODS

This cross-sectional, population-based study was carried out in the period from September 2007 to August 2008, in the rural and urban zones of the Municipality of Rio Branco. The analyzed data were obtained from the inquiry Health and Nutrition of Adults and Children of Rio Branco. The traffic accident was one of the researched outcomes among many health problems and risk factors.

The sampling process of the inquiry was performed by drawing households through two-stage clustering. The census tracts of the 2005 *Pesquisa Nacional por Amostra de Domicílios* (National Household Sample Survey) were the primary sampling units. Precision criteria, according to Vigitel, were established according to the estimate of confidence intervals for proportion, according to the main aims of the survey (to estimate the prevalence of chronic diseases in the dwelling population older than 18 years).[d]

Among the 250 census tracts of Rio Branco, 35 were randomly selected to compose the sample, of which 31 were urban and four, rural. In each sector, 25 households were drawn, totaling 875 households, equiprobable. Predicting a 15% loss for diverse reasons, the sample's

[b] Ministério da Saúde. Saúde Brasil 2006: uma análise da desigualdade em saúde. Brasília; 2006[citado 2010 nov]. Disponível em: http://pt.scribd.com/doc/40207856/UMA-ANALISE-DA-DESIGUALDADE-EM-SAUDE

[c] Departamento Nacional de Trânsito. Lei no 11.705 de 19 de junho de 2008. Altera a Lei no 9.503, de 23 de setembro de 1997, que 'institui o Código de Trânsito Brasileiro', e a Lei no 9.294, de 15 de julho de 1996, que dispõe sobre as restrições ao uso e à propaganda de produtos fumígeros, bebidas alcoólicas, medicamentos, terapias e defensivos agrícolas, nos termos do § 4o do art. 220 da Constituição Federal, para inibir o consumo de bebida alcoólica por condutor de veículo automotor, e dá outras providências. Diario Oficial Uniao. 20 jun 2008;Seção1:1. Available from: http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2008/lei/l11705.htm

[d] Ministério da saúde. Vigitel Brasil 2007. Vigilância para fatores de risco e proteção para doenças crônicas por inquérito telefônico. Brasília; 2008

size was amplified to 977 households, considering an average density of two adults per household.

The final sample was composed of 1,516 adults (older than 18 years), who answered the research in home interviews performed by a trained team and with standardized procedures for data collection. The interviews were performed in different periods and in all week days. The percentage of nonresponse was zero, and in all the households the dwellers agreed to be interviewed and signed a consent document.

The dependent variable – traffic accident – was analyzed based on the question: "Have you suffered or have you been involved in any traffic accidents in your life?". A standardized definition of traffic accident was read by the interviewer to all the participants: "Traffic accident is any running over, car crash, accident with bicycles, motorcycles and falls inside buses or from them, trucks, which happen on streets or highways. In this study, we did not include accidents involving trains, streetcars and the underground. I call your attention to the fact that a traffic accident can be more or less serious and people can get hurt or not".

Alcohol consumption was evaluated initially through the question "do you usually consume alcoholic beverages?" In case of an affirmative answer, the subject was asked: "have you ever had more than five drinks in one single occasion?", for men, or "do you usually have more than four drinks in one single occasion?", for women. Men and women who answered affirmatively were asked whether they drove right after drinking that amount of alcohol. This last question was considered as the variable "drives drunk". These questions are equal to the ones of the VIGITEL survey.

The age on the date of the interview was categorized based on a publication of the World Health Organization (WHO)[e] for TA prevention, according to years of experience in driving: recently licensed (18 to 25 years), more experienced drivers whose behavior in the traffic is less risky (older than 25 up to 45 years), and drivers who present a safer profile for driving (older than 45 years).

The income variable was divided into ten tiers and, in the present study, it was categorized according to a division proposed by Fundação Getúlio Vargas[f] (up to two minimum salaries, from two to five and above five minimum salaries).

The chi-square test was used to select the variables associated with the outcome, considered statistically significant ($p< 0.05$), with a 95% confidence interval (95%CI). Then, the prevalence ratios (PR) were calculated. The bivariate analysis preceded the weighing of the sample, to obtain the crude PR. The multivariate analysis was calculated by means of Poisson regression with the svy module and the inclusion of the sample's weighing variables, firstly for sex and age, as they frequently are confounding variables, and subsequently for the other independent variables. The variables entered the model according to the highest PR, the lowest p-value, the most restricted 95%CI, the importance of the variable according to the literature, and the maintenance of statistical significance with $p<0.05$ after entering the model.

Data input was performed by means of the numerical coding of the answers in a database of the program EpiInfo version 6.0. The quantitative variables were analyzed by means of the program Stata version 10.0

The research was approved by the Research Ethics Committee of Universidade Federal do Acre, protocol no. 23.107.00150/2007-22, according to Resolution number 196/96 of the National Health Council.

## RESULTS

In the researched population, women predominated, as well as non-whites, urban zone inhabitants, people aged >25 to 49 years and with fixed job. Half of the interviewees informed they received between two and five minimum salaries, 39.8% said they received up to two minimum salaries and only 10.1% had income higher than five minimum salaries.

The general prevalence of self-reported traffic accident that occurred at any time before the interview was 36.0% (Table 1).

In the bivariate analysis (Table 2), the highest PR were for the occurrence of TA in men, urban zone inhabitants, workers who were employed at the time, non-whites, people whose level of schooling was below two years, who reported alcohol consumption and who drove after excessive consumption of alcohol.

In the sex- and age-adjusted multivariate analysis (Table 2), all variables maintained high PR for the categories that were considered of risk for TA. The marital status variable had no statistical significance.

In the multivariate analysis (Table 3), among the independent variables that remained in the multiple model, the higher probability of referring TA was related to men aged between 18 and 25 years, with income higher than five minimum salaries and who usually ingest alcohol. In this analysis, when the variables with three

[e] World Health Organization. The World Health Report 2002: reducing risks, promoting healthly life. Geneva; 2002[cited 2008 Aug]. Available from: http://www.who.int/whr/2002/en/

[f] Gonzaga G, Camargo JM, Neri MC. Efeitos informais do salário mínimo e pobreza. São Paulo: Fundação Getúlio Vargas; 2000[cited 2008 Aug]. Available from: http://virtulbib.fgv.br/dspace/handle/10438/677 (Ensaios econômicos, 375).

**Table 1.** Distribution of the participants in the study, according to socioeconomic, demographic and lifestyle characteristics. Rio Branco, Northern Brazil, 2007-2008. (n = 1,516)

| Variables | n | % |
|---|---|---|
| Sex | | |
| Female | 860 | 56.7 |
| Male | 656 | 43.3 |
| Age group (years) | | |
| 18 to 25 | 417 | 27.5 |
| >25 to 45 | 651 | 42.5 |
| >45 | 448 | 30.0 |
| Skin color | | |
| White | 252 | 16.6 |
| Non-white | 1,262 | 83.4 |
| Residence zone | | |
| Rural | 118 | 7.8 |
| Urban | 1,398 | 92.2 |
| Income (minimum salaries) | | |
| < 2 | 593 | 39.8 |
| 2 to 5 | 747 | 50.1 |
| >5 | 151 | 10.1 |
| Has a job | | |
| Yes | 832 | 54.9 |
| No | 678 | 45.1 |
| Alcohol consumption | | |
| Yes | 464 | 30.6 |
| No | 1,052 | 69.4 |
| Drives drunk | | |
| Yes | 53 | 3.5 |
| No | 1,463 | 96.5 |
| Traffic accident | | |
| Yes | 546 | 36 |
| No | 970 | 64 |

Note: Differences in the absolute values of the frequencies correspond to individuals with no information or "does not apply" (if they answer "no" in the previous question they do not answer the following one).

**Table 2.** Bivariate analysis according to sociodemographic and lifestyle characteristics and the occurrence of traffic accidents. Rio Branco, Northern Brazil, 2007-2008.

| Variables | Crude prevalence ratio (95%CI) | Adjusted prevalence ratio (95%CI) |
|---|---|---|
| Sex | | |
| Female | 1 | 1 |
| Male | 1.60 (1.43;1.79) | 1.87 (1.44;2.41) |
| Age group (years) | | |
| >45 | 1 | 1 |
| >25 to 45 | 1.30 (1.10;1.55) | 1.35 (1.09;1.69) |
| 18 to 25 | 1.32 (1.10;1.59) | 1.39 (1.18;1.75) |
| Residence zone | | |
| Rural | 1 | 1 |
| Urban | 1.62 (1.156;2.27) | 1.57 (1.16;2.12) |
| Level of schooling (years) | | |
| > 8 | 1 | 1 |
| 2 to 8 | 1.38 (1.10;1.73) | 1.23(0.99;1.54) |
| < 2 | 1.72 (1.42;2.08) | 1.77 (1.46;2.14) |
| Income (minimum salaries) | | |
| <2 | 1 | 1 |
| 2 to 5 | 1.47 (1.25;1.72) | 1.49 (1.23;1.80) |
| >5 | 1.95 (1.59;2.38) | 2.14 (1.59;2.86) |
| Marital status | | |
| Married | 1 | 1 |
| Single/ separated | 0.99 (0.88;1.12) | 1.09 (0.82;1.45) |
| Skin color | | |
| White | 1 | 1 |
| Non-white | 1.33 (1.22;1.45) | 1.44 (1.18;1.76) |
| Has a job | | |
| No | 1 | 1 |
| Yes | 1.33 (1.06;1.67) | 1.34 (1.16;1.54) |
| Alcohol consumption | | |
| No | 1 | 1 |
| Yes | 1.61 (1.39;1.87) | 1.37 (1.08;1.75) |
| Drives drunk | | |
| No | 1 | 1 |
| Yes | 2.93 (1.69;5.01) | 1.48 (1.18;1.86) |

categories were considered, it was observed that age showed inverse association with the analyzed outcome, while income presented a positive association, both with significant trend (p trend).

## DISCUSSION

The present study identified high prevalence of self-reported traffic accidents. The factors associated with the occurrence of TA are the same ones reported in the literature.

Among the people who reported having suffered a traffic accident, men and people who stated that they consume alcohol predominated. An inquiry conducted in the city of Campinas (Southeastern Brazil) with university students also revealed higher risk of TA in the men who adopted risk behaviors, including driving after drinking.[8] In a telephone inquiry carried out in the United States, 21% of the interviewees answered that they drive vehicles less than two hours after consuming alcohol.[15]

The age group from 18 to 25 years showed higher PR compared to the population aged more than 45 years. The younger group is considered a risk group due to their

**Table 3.** Final result of the multivariate analysis with Poisson Regression of the factors associated with occurrence of traffic accidents. Rio Branco, Northern Brazil, 2007-2008.

| Variable | Crude PR | Adjusted PR |
|---|---|---|
| Alcohol consumption | | |
| No | 1 | 1 |
| Yes | 1.61 (1.39;1.87) | 1.25 (0.97;1.62) |
| Sex | | |
| Female | 1 | 1 |
| Male | 1.60 (1.43;1.79) | 1.45 (1.12;1.87) |
| Income | | |
| <2 | 1 | 1 |
| 2-5 | 1.47 (1.25;1.72) | 1.43 (1.07;1.91) |
| >5 | 1.95 (1.59;2.38) | 1.88 (1.25;2.83) |
| P-trend | | <0.01 |
| Age (years) | | |
| >45 | 1 | 1 |
| >25 to 45 | 1.33 (0.98;1.81) | 1.33 (0.98;1.81) |
| 18 to 25 | 1.45 (1.02;2.05) | 1.45 (1.02;2.05) |
| P-trend | | <0.01 |

inexperience in the traffic, to their behavior that is typical of immature individuals and to the recent obtention of the driving license. A 2002 WHO report showed that people aged between 15 and 44 years were responsible for more than half of all deaths in the traffic.[e] In the present study, the younger individuals, even with lower exposition time, presented higher PR of accidents compared to the older ones. This may be explained by the recent acceleration of urbanization in the studied municipality and by the higher availability of credit for the purchase of motor vehicles in Brazil. Besides, until recently, Rio Branco's population had been predominantly rural; therefore, the older inhabitants were exposed to a less chaotic traffic, with a smaller fleet of vehicles.

People who have jobs exhibited higher PR, which can be explained by the fact that they are exposed to traffic everyday in the way to the workplace. In the present research, accidents that occurred in this route were considered traffic accidents. A study has shown a positive association between distance traveled and driving during rush hours with the occurrence of traffic accidents.[12]

The capital city of the state of Acre is an area that has been recently occupied. It received a large flow of immigrants in the time of the expeditions of Marshal Rondon (1913-1914), when the model of development based on the Rubber Cycle was initiated, and the population spread among the rubber plantations. During the military policies in the 1960s and 1970s, the Amazon Forest was felled so that cattle-raising and agriculture could be developed, with the consequent unstructuring of the native rubber plantations. This fact caused the transfer of families to urban peripheries, without adequate orientation of the urbanization process. The cities expanded, mainly with the migration of families from the South and Center-West Regions, which increased the State's occupation index.[g] Thus, the population was mainly constituted of Northeasterners, Southeasterners, Indians and Bolivians, who had the chance of improving their economic status. The whites are a minority that came from other States in the South of Brazil, during the period of cattle-raising expansion.

The present research revealed higher prevalence of TA among non-white individuals, who are the majority in the municipality and do not represent the low-income strata.

The fact that individuals with income above five minimum salaries constitute a risk category is in accordance with the theoretical framework. Upper-class students living in Campinas and whose families had more than two cars also presented higher number of non-fatal accidents for estimates of the odds ratio after sex and age adjustments.[8]

A study conducted in Feira de Santana (Northeastern Brazil) analyzed the spatial distribution of deaths by external causes and found that the neighborhoods considered as having medium and high socioeconomic status presented higher rates of traffic accidents.[1]

People with up to two years of level of schooling showed much higher PR (1.83) compared to those with more than nine years. However, this variable did not remain in the multivariate model. The analysis of the model without the level of schooling variable shows good adjustment for the income variable and reveals high prevalence of TA in the category above five minimum salaries, adjusted for the other variables. This may suggest that high income groups show higher prevalence of TA, but not necessarily do the richer groups have higher level of schooling. This contradiction may be explained by the fact that, in the 1970s, Rio Branco was an immigration pole due to the development of cattle-raising and to the fell of the forest, with accelerated economic growth. Many of these immigrants grew rich quickly, but the educational situation of their families did not improve.

The PR is higher in the urban zone, which can be explained by the greater exposure that city inhabitants have to the traffic. However, the rural means of transport has been changing, with the invasion of motorcycles and replacement of animal traction by tractors. Countryside drivers are less inspected and drive less carefully; thus,

[g] Instituto Brasileiro de Geografia e Estatística. IBGE – cidades @ histórico – Rio Branco (AC). Brasília; 2010[cited 2010 Nov]. Available from: http://www.ibge.gov.br/cidadesat/topwindow.htm?1

gravity and fatality are greater in the TA in the rural zone.[10] This fact might also justify the lower occurrence of non-fatal TA among rural zone interviewees.

The majority of studies about TA uses as information source secondary mortality data, hospital records, data from *Instituto Médico Legal* (IML – Coroner's Office) or police reports, which are subject to underreport and information loss,[2,5] or selection biases, like in Vigitel.[d]

In this sense, the present study approaches the TA in a differentiated way, even though it has limitations. Because it is grounded on a population-based inquiry, it is difficult to obtain reliable answers when the interviewee is questioned about a polemic and little defined theme, like skin color; about social aspects, like family income; or socially reprehensible behaviors, like alcohol consumption, mainly when it involves driving vehicles. These difficulties are usually found in epidemiological studies about conduct disorders due to the prejudice and stigma that exist in society.[4] This aspect should be considered in the interpretation of the results, as the estimates may be underestimated.

In view of what has been exposed, it is suggested that families with income higher than five minimum salaries should be focused by TA prevention programs in Rio Branco, aiming at the maximization of their results.

## REFERENCES


1. Araújo EM, Araújo TM, Santana F. Distribuição desigual da mortalidade por causas externas: avaliação de aspectos sócio-econômicos. *Rev Baiana Saude Publica*. 2005;29(2):262-72.
2. Barros AJD, Amaral RL, Oliveira MSB, Lima SC, Gonçalves EV. Acidentes de trânsito com vítimas: sub-registro, caracterização e letalidade. *Cad Saude Publica*. 2003;19(4):979-86. DOI:10.1590/S0102-311X2003000400021
3. Campos VR, Salgado R, Rocha MC, Duailibi S, Laranjeiras R. Prevalência do beber e dirigir em Belo Horizonte, Minas Gerais, Brasil. *Cad Saude Publica*. 2008;24(4):829-34. DOI:10.1590/S0102-311X2008000400013
4. Coutinho ESF. Alcoolismo e problemas relacionados-dificuldades na implementação de estudo de prevalência**.** *Cad Saude Publica*. 1992;8(1):22-9. DOI:10.1590/S0102-311X1992000100003
5. Drummond Jr M, Lira MMTA, Freitas M, Nitrini TMN, Shibao K. Avaliação da qualidade da informação da mortalidade por acidentes não especificados e eventos com intenção indeterminada. *Rev Saude Publica*. 1999;33(3):273-80. DOI:10.1590/S0034-89101999000300008
6. Galduróz JCF, Caetano R. Epidemiology of alcohol use in Brasil. *Rev Bras Psiquiatr.* 2004;26(Suppl. 1):3-6. DOI:10.1590/S1516-44462004000500002
7. Hingson R, Winter M. Epidemiology and consequenses of drinking and driving. *Alcohol Res Health*. 2003;27(1):63-78.
8. Marin-León L, Vizzotto MM. Comportamento no trânsito: um estudo epidemiológico com estudantes universitários. *Cad Saude Publica*. 2003;19(2):512-23. DOI:10.1590/S0102-311X2003000200018
9. Mello Jorge MHP, Latore MRDO. Acidentes de trânsito no Brasil, dados e tendências. *Cad Saude Publica*. 1994;(10Suppl 1):19-44. DOI:10.1590/S0102-311X1994000500003
10. Palouzzi JL, Ryan GW, Victoria E, Hardeman E, Youngli X. Economic development's effect on road transport-related mortality among different types of road users: a cross-sectional international study**.** *Accid Anal Prev.* 2007;39(3):606-17.
11. Pedem M, Scurfield R, Sleet D, Mohan D, Hyder AA, Jarawan E, et al**.** World Report on Road Traffic Injury Prevention. Geneva: World Health Organization; 2004.
12. Pinho FMO, Pinho LMO, Oliveira VRC, Lima YEPO, Pereira CA, Melo CR, et al. Comportamento de risco no trânsito: um estudo entre jovens universitários. São Paulo: Associação Brasileira de Medicina do Tráfego; 2009.
13. De Souza MFM, Malta DC, Conceição GMS, Silva MMA, Gazal-Carvalho C, De Morais Neto OL. Análise descritiva e tendências de acidentes de transporte terrestre para políticas sociais no Brasil. *Epidemiol Serv Saude*. 2007;16(1):33-44.
14. Van Beeck EF, Borsboon GJJ, Mackenbach JP. Economic development and traffic accident in the industrialized world, 1962-1990. *Int J Epidemiol.* 2000;29(3):503-9.
15. Zador PL, Krawchuk SA, Voas RB. Alcohol related relative risk of driver fatalities and driver involviment in fatal crashes in relation to driver age and gender, an up date using 1996 data. *J Stud Alcohol.* 2000;61(3):387-95.
16. Zhao J, Mann RE, Chipman M, Adlaf E, Stoduto G, Smart RG. The impact of driver education on self-reported collisions among young drivers whith a graduated license. *Accid Anal Prev.* 2008;38(1):35-42.


Paper based on the Master's dissertation by Magalhães AF, presented to Universidade Federal do Acre in 2009
The authors declare that there are no conflicts of interests.