

MORTALITY FROM LAND TRANSPORT ACCIDENTS: A COMPARATIVE ANALYSIS

Marília Angelina Ferreira Papa¹, Danielle Wisnieswski¹, Kelly Cristina Inoue², Carlos Alexandre Molena-Fernandes²,
Yolanda Dora Martinez Évora³, Laura Misue Matsuda⁴

ABSTRACT: This is an epidemiological, descriptive, comparative study whose objective was to compare the mortality from Land Transport Accidents in the cohorts: 2006/2007 and 2009/2010, in Maringá in the Brazilian State of Paraná. Inferential statistics were undertaken (Chi-squared test) using the Statistica 8.0® software. It was observed that Land Traffic Accidents are the main causes of mortality from external causes – the local coefficient of mortality was 34.98%, above the national rate, principally among pedestrians, motorcyclists and men between 20 and 39 years old. And that in the comparison of the differences of the coefficient of mortality between the cohorts, there was an increase of 26.4%. It is concluded that there was, in the city, an increase of the coefficient of mortality from Land Transport Accidents. Thus, further investment is suggested in traffic education programs; inspections; and in studies evaluating the impact of the measure restricting the use of alcohol and driving in the traffic.

DESCRIPTORS: Traffic accidents; Epidemiology; Mortality.

¹RN. M.A in Nursing. State University of Maringá. Paranavaí-PR-Brazil

²Physical Education professional. Ph.D in Pharmaceutical Sciences. Professor at the State University of Paraná. Paranavaí-PR-Brazil

³RN. Ph.D in Nursing. Professor of the University of São Paulo. Ribeirão Preto-SP-Brazil

⁴RN. Ph.D in Nursing. Professor of the State University of Maringá. Maringá-PR-Brazil

Corresponding author:

Marília Angelina Ferreira Papa
Universidade Estadual de Maringá
Rua Prof. Itamar Orlando Soares, 115 - 87020-270 - Maringá-PR-Brasil
E-mail: marilia_fpapa@hotmail.com

Received: 12/12/2012

Approved: 06/01/2014

INTRODUCTION

In the Brazilian setting, due to its high impact on morbidity and mortality, principally in the young male population, mortality from external causes – considered avoidable or reducible – represents a serious public health problem⁽¹⁾. The causes of avoidable or reducible deaths are defined as

those which are preventable, totally or partially, through effective actions from the health services which are accessible in a specific place and at a specific time^(2:174).

In 2010, external causes constituted the third-largest group of causes of death in Brazil, coming to occupy the first position when the analysis was restricted to the group of people aged between one and 39 years old⁽³⁾. This data is worrying, as in addition to the loss of potential years of life, the external causes can result in sequelae, with a consequent increase in demand for the health services in their various levels of assistential complexity and an increase of the financial costs, which in 2011 were close to R\$ 1,000,000,000⁽⁴⁾.

In 2010, land transport accidents (LTA), coded from V01 to V89 in the ICD-10⁽⁵⁾, were the second most common cause of mortality in Brazil, with approximately 42,844 deaths⁽⁴⁾.

The prevention of traffic accidents is a cause for concern in Brazil, and in 2010 a proposal was developed for the construction of a National Plan for Accident Reduction and Road Safety, based on five pillars: Inspection; Education; Health; Infrastructure; and Vehicle Safety⁽⁶⁾.

It stands out that, in the Brazilian context, the poor state of the roads, the age of the transport fleet and its inadequate maintenance, and the growing introduction of the motorcycle as an instrument of work, among others, have contributed to the occurrence of accidents⁽¹⁾. Furthermore, alcohol stands out in the causing of LTA, which has led various countries, including Brazil, to establish legal measures and campaigns in the media for the reduction of the effects resulting from the association between alcoholic drinks and driving, with a focus directed particularly at raising the awareness of young motorists⁽⁷⁾.

In Brazil, in this perspective, on 19th June 2008, Law N. 11,705⁽⁸⁾, known as ‘The Dry Law’, was put into statute; this changed the Brazilian Traffic Code by introducing legal mechanisms which inhibit the consumption of alcoholic drinks by the drivers of motor vehicles. In spite of this law’s implantation, in 2010,

LTAs resulted in 12.6% of avoidable premature deaths in Brazil, and, in inserting LTA deaths in the group of external causes, the number rose to 30%, in the same period⁽⁴⁾. In Maringá, in State of Paraná, Brazil, which city had 357,077 inhabitants in 2010, the LTAs occupied first position in deaths related to external causes, totalling 162 deaths. It was also ascertained that this cause of death increased by 1% in the period 2008 – 2010 in this city⁽⁴⁾.

Regarding the problem presented, the analysis of mortality from LTA is important, and data concerning it make more effective decision-making possible, in the different segments of society for the prevention and reduction of its occurrence and harm. In this context, this study is anchored in the following question: How was mortality from LTA presented, in the 2006/2007 and 2009/2010 cohorts in the city of Maringá? In order to respond to this question, the present study aims to compare the mortality from LTA which occurred in the cohorts of 2006/2007 and 2009/2010, in Maringá, Paraná, Brazil.

METHOD

This epidemiological, descriptive, comparative study is based in secondary data regarding mortality from land transport accidents which occurred in the city of Maringá in Paraná, in the 2006/2007 and 2009/2010 cohorts. This period was selected due to the implantation of Law N. 11,705, of 19th June 2008⁽⁷⁾, which establishes restrictive measures on consumption of alcoholic drinks by the drivers of motor vehicles.

The data on mortality were obtained from the Ministry of Health’s Mortality Information System, through the I.T Department of the Unified Health System⁽⁴⁾. In this way, in the above-mentioned city, the deaths were selected in the period 2006 to 2010 for which the basic cause had been the occurrence of LTA, identified by Chapter XX, codes V01 to V89 of the ICD-10⁽⁴⁾, available on the DATASUS site.

A complete analysis of the databases of the Brazilian states, of Paraná, and of Maringá was undertaken, in relation to the total number of deaths from external causes and from LTA. In this process, records were excluded where there was no information referent to the sex or age of the person who died, this last variable being grouped in four categories of age range (0 to 19 years old; 20 to 39 years; 40 to 59 years old and 60 years old and over).

The population data were also obtained on the Department of the Unified Health System webpage. For the first period analyzed, the mean of the popula-

tions of the years 2006 and 2007 was used, and in the second period, the mean of the years 2009 and 2010 was used. The variations in mortality from LTA in the periods 2006/2007 and 2009/2010 were verified through the difference in the coefficients of mortality, with the aim of identifying the percentage variation in the rates of mortality in the periods investigated. For the calculation of the coefficient of mortality, a previously standardized formula was used, which consists in the division of the total of deaths from LTA by the population resident in the same area and in the same period, multiplying the result per 100,000 inhabitants.

The statistical analyses were undertaken using the Statistica 8.0 software®, which used the Chi-squared test (χ^2) for measuring the association between the variables, calculating the Odds Ratio (OR). The level of significance adopted for the analysis was 5%, with the confidence interval (CI) of 95%. It is noted that the choice of this test is due to its dichotomous outcome (Death and Not death).

The data used in this research appear in public databases. As a result it was not necessary to submit the protocol of this analysis to the Research Ethics Committee.

RESULTS

In 2006, 60,560 deaths were recorded in Paraná. Of these, 2,969 were from LTA, corresponding to 4.9% of

the deaths. In Maringá, in this same period, 95 deaths resulting from LTA were recorded, corresponding to 3.19% of deaths from accidents in the State and to 3.71% of deaths in the city. That year, LTA were the most common cause of deaths related to external causes in Maringá.

Regarding 2010, 67,284 deaths were recorded in Paraná. Of these, 3342 were due to LTA, corresponding to 4.96% of the deaths. In Maringá, in this same period, 162 deaths from LTA were recorded, corresponding to 4.84% of the deaths caused by accidents in the State and to 5.41% of deaths in the city itself; which caused LTA to continue to be the principal cause of death in this area⁽⁴⁾. The distribution of deaths from LTA in the period 2006 – 2010, by ICD-10 category (V01 – V89) is shown in Table 1.

Figure 1 shows the coefficient of mortality by Land Transport Accidents from 2006 to 2010, by sex.

In considering the data from Figure 1 and the percentage variation of the coefficients of mortality from LTA in the first period (2006) and the last (2010), one can verify an increase of 35.47% for the population analyzed. If the data is restricted to the male sex, this value rises to 41.95%; while for the female sex there was a percentage variation of only 5.39%. In calculating the difference between the coefficients of mortality by LTA in Maringá, in the two cohorts 2006/2007 and 2009/2010, it was ascertained that there was an increase of 26.4% in the coefficient of mortality from LTA, as demonstrated in Table 2.

Table 1- Distribution of the deaths from Land Transport Accidents, by ICD-10 category (V01 – V89) and year of occurrence. Maringá-PR-Brazil, 2006-2010

CID-10 \ YEAR	2006		2007		2008		2009		2010	
	n	%	n	%	n	%	n	%	n	%
Pedestrian injured in TA.	38	40	37	35,24	44	37,29	35	32,71	50	30,87
Motorcyclist injured in TA	26	27,36	34	32,38	36	30,50	28	26,16	44	27,16
Car occupant injured in TA	13	13,69	26	24,77	26	22,04	29	27,10	54	33,34
Other accidents – land transport	13	13,69	1	0,95	4	3,39	8	7,48	9	5,55
Cyclist injured in TA	1	1,05	6	5,71	4	3,39	5	4,67	5	3,08
Occupant of small lorry injured in TA	4	4,21	-	-	3	2,54	1	0,94	-	-
Occupant of a heavy truck injured in TA	-	-	1	0,95	1	0,85	-	-	-	-
Bus occupant injured in TA	-	-	-	-	-	-	1	0,94	-	-
Total	95	100	105	100	118	100	107	100	162	100

Source: Mortality Information System/ Ministry of Health.
TA: Transport accident

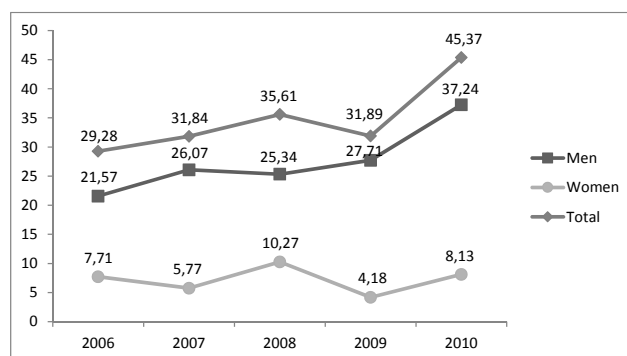


Figure 1- Coefficient of mortality by Land Transport Accidents, by sex. Maringá-PR-Brazil, 2006-2010.

Table 2 - Coefficient of mortality from Land Transport Accidents, by year of occurrence. Maringá, 2006/2007-2009/2010

Period	Population (n)	Mean of populations (%)	Mean coefficient (x 10 ⁻⁵)	Difference between coefficients (%)
2006-2007	200	100	30,56	
2009-2010	269	134,5	38,63	+26,4

Source: Mortality Information System/Ministry of Health.

By relating data of the total of general deaths in Maringá, and deaths from LTA, the coefficient of mortality was calculated for the following variables: sex and age range, in both the cohorts studied (2006/2007 and 2009/2010). Thus, Table 3 presents the mean coefficient and the odds ratio for deaths by LTA in the 2006-2007 cohort,

in accordance with the socio-demographic variables.

Table 4 also shows the mean coefficient and the odds ratio for deaths from LTA, by socio-demographic variables, related to the 2009-2010 cohort. As shown in Table 4, of the total deaths in the city studied, 226 were from LTA. All the variables were statistically significant.

Table 3- Sex and age range, by death from Land Transport Accident. Maringá-PR-Brazil, 2006-2007

Variables	Total of general deaths	Deaths by LTA* (n)	%	Mean coefficient	p-value	Odds ratio
Sex						
Male	2889	156	78	49,87	0,000	3
Female	2352	44	22	12,91	-	-
Age range						
0 - 19 years	369	26	13,26	9,69	0,000	3,9
20 - 39 years	367	79	40,3	35,12	-	-
40 - 59 years	1099	50	25,51	37,62	0,000	5,8
60 and over	3425	41	20,91	59,45	0,000	22
Total	5241**	196	100	62,78	-	-

Source: Mortality Information System/ Ministry of Health.

*Land Transport Accident. **In the total of deaths, three were not counted for the year 2006.

Table 4- Sex and age range, by death from Land Transport Accident. Maringá-PR-Brazil, 2009-2010

Variables	Total of general deaths	Deaths by LTA* (n)	%	Mean coefficient	p-value	Odds ratio
Sex						
Male	3292	226	84,01	67,92	*0,000	4,2
Female	2474	43	15,99	11,79	-	-
Age range						
0 - 19 years	284	31	11,52	13,75	*0,000	2,4
20 - 39 years	465	106	39,4	43,58	-	-
40 - 59 years	1189	71	26,39	38,48	*0,000	4,6
60 and over	3824	61	22,69	86,68	*0,000	18,2
Total	5766	269	100	39,85	-	-

Source: Mortality Information System/Ministry of Health.

*Statistically significant difference. ** Land Transport Accident

DISCUSSION

At the time of writing, LTA are the most common cause of death from external causes in the city of Maringá and are the second most common in Brazil, outnumbered only by deaths from violence⁽⁴⁾. However, the dimension of the problem related to LTA is not limited to the high mortality, due to the fact that among its various consequences, one should stress the innumerable sequelae and the suffering caused to the families and society, as well as the raising of the social and economic costs, due to the high impact on the public coffers.

As an example of the above assertion, one study aiming to describe the estimated occurrence of injuries resulting from traffic and the factors related to the Brazilian population identified that the LTA caused 30.7% of those injured to cease habitual activities; and concluded that the scale of the injuries in traffic justifies bringing forward preventive and legislative measures for reducing these events⁽⁹⁾. Furthermore, the survivors of LTA, especially young adults and car occupants, when they survive, may be totally or functionally disabled⁽¹⁰⁾.

As observed in Table 1, the most frequent causes of death from LTA as coded by the ICD-10 were, respectively: pedestrian injured in a transport accident and motorcyclist injured in a transport accident.

The fact of pedestrians and motorcyclists being the predominant victims of LTA corroborates another study⁽¹¹⁾. An analysis of the health situation, and of the national and international agenda of health priorities undertaken by the Ministry of Health, indicated that referring to deaths in the year of 2008, there was a higher proportion caused by LTA in the most vulnerable

groups in the transport system, these being, respectively: pedestrians (24.2%); motorcyclists (23.4%); followed by occupants of vehicles (22.4%)⁽¹²⁾. It is inferred that the higher mortality in the 'injured pedestrian' group in transport accidents is due to greater exposure of the body, with an absence of means of protection for minimizing the harm resulting from the impact at the time of the accident.

The literature indicates that in the cases of people being run over, high rates of mortality predominated among the elderly⁽¹³⁾. After all, people aged 60 years old or over have less agility when crossing roads and greater weakness regarding injuries and bodily harm.

Regarding motorcyclists, it is important to note that the high mortality in this group may result from the increase in the number of motorcycles on the road in Brazil and also from the fact that the only means of security possible to use is the helmet, leaving the rest of the body entirely unprotected against impacts. In Brazil, there is growing use of motorcycles in the labor market, which, associated with the difficulty motorists have in seeing them, inappropriate behaviour in traffic, and failure to respect the laws, has favored the occurrence of LTA⁽¹¹⁾.

It should be noted that the LTA in the category 'Injured bus occupant' in a transport accident had only one occurrence, in 2009 (Table 1). The lower number of deaths in this category may be related to the fact that public transport vehicles present higher protection to the occupants, both due to the size of the vehicle and due to its low speed on urban roads, this being caused by the high volume of traffic; the reduced speed limit, and the precarious conditions on the public highways⁽¹⁴⁾.

Further, referring to Table 1, it may be noted that

there was an apparent reduction in mortality from LTA in Maringá in 2009. The coefficient of mortality, however, did not follow the same tendency of the number of occurrences of deaths by LTA in the city investigated. As may be seen in Figure 1, the highest coefficient was reached in 2008, and, although there was a reduction in 2009, 2010 had the highest coefficient of mortality among the periods analyzed. In contrast with this, a study regarding the analysis of mortality by LTA in Brazil before and after the above-mentioned Law evidenced that there was a significant proportion of reduction in the risk of death in the Brazilian state capitals⁽¹⁵⁾.

The variables of sex and age range showed a strong association with the occurrence of death by LTA, both for the first (Table 3) and second cohort (Table 4). In comparing the cohorts, one may note that there was an increase of the odds ratio for the male sex from 3 to 4.2; with a reduction of the odds ratio for death by LTA in all the ages, when compared with the reference category, the age range of 20 to 39 years old.

The profile observed in this study is in consonance with that of other studies, which also showed male individuals as the most frequent victim or at greater risk of suffering LTA^(13,16-18). This is because men have more aggressive behaviors in traffic than women do, often manifested through undertaking risky manoeuvres, the use of alcoholic drinks and disrespect for the rules in force, in addition to the fact that the profession of driver/motorist remains primarily male⁽¹⁸⁾.

Because in both periods the variable of age range was associated with death by LTA, proportionate to advancing age, an increase in the coefficient of mortality and odds ratio is evidenced (Tables 3 and 4). It is inferred that these data are related to the fact that young adults have less experience in traffic; adopt behaviors typically related to immaturity; and, have recently obtained their driving license⁽¹⁸⁾.

In order to reduce LTA among the young, it is considered relevant to use specific strategies which reach this group, so as to prevent or reduce these events, such as: the development of educational strategies which aim to change habits and behaviors, principally those of young male drivers; intensification of inspections, with articulated and integrated actions from the government and non-governmental sectors; and the provision of information through continuous and systematized education.

The highest proportion of deaths by LTA found among males and in the age range between 20 and 39 years old is corroborated by another study⁽¹¹⁾. However,

the coefficients of mortality found diverged from the national context, as recent mortality statistics demonstrate that in the developed countries, the mortality rate is only 10.3 deaths per 100,000 inhabitants, while in the countries of medium and low income, the coefficients are 19.5 and 21.5 deaths per 100,000 inhabitants respectively. For Brazil, the mortality rate from this cause is 18.3 deaths per 100,000 inhabitants⁽⁴⁾.

In contrast with this, the mean, was 34.98 deaths per 100,000 inhabitants in the period 2006 – 2010; that is, far above the national rate. In the light of the data obtained in this study and the results found in the other study⁽¹⁹⁾, it is necessary for there to be greater investment by the state in the development and maintenance of educational strategies, associated with effective public policies, so as to reduce the high rates of LTA.

Investing in changes of the population's habits and behaviors, therefore, is shown as a challenge for the country, managers, educators and for society in general, so as to make people careful and respectful of the traffic laws, associated with the implantation of strategies for the promotion of safe environments, and the reduction of the effects caused by the relationship between drinking and driving.

Based in the results found, it is considered that the National Plan for Accident Reduction and Road Safety needs to be put into effect, as this includes the articulation of strategies, through actions, goals and implementation schedules which aim for the reduction of accidents and deaths in traffic. For this, the involvement of all the segments of society is necessary.

CONCLUSION

Based on the results presented, it is observed that the local coefficient of mortality was 34.98%, above the national rate, principally among pedestrians, motorcyclists and men in the age range of 20 to 39 years old; and that in the comparison of the differences of coefficient of mortality between the cohorts, there was an increase of 26.4%. It is suggested, therefore, that strategies consistent with road safety should be formulated, supported by national policies, plans and programs establishing specific interventions, such as: improvement of the road infrastructure; the encouragement and facilitation of use of alternative forms of transport; appropriate infrastructure for health institutions for attending the victims of trauma; and educational practices for the population, in all segments of society, aiming for the exercising of citizenship and

reduction of LTA.

As limitations of this study, one can consider the absence of data regarding mortality by LTA in the latest Mortality Information System, which hinders more recent investigation on the issue addressed, and the short period addressed. As a result, there is a need for the continuity of studies analyzing longer periods regarding mortality by LTA and which make it possible to reveal the specific impact of the measure restricting driving under the influence of alcohol.

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