Original article

Deaths and serious injuries due to traffic accidents in Goiânia, Brazil – 2013: the magnitude and associated factors*

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Abstract

Objective: to identify the magnitude and factors associated with death and serious injuries among victims of traffic accidents in the urban area of Goiânia, Brazil. **Methods**: cross-sectional study with linkage between records of the Mortality Information System (SIM) Hospital Information System of the Brazilian National Health System (SIH/SUS) and occurrences of traffic accidents, from January to June 2013; Poisson regression was used. **Results**: among 9,795 identified victims, there were 155 deaths and 1,225 serious injuries; cyclists (Incidence ratio [IR]=2.26; 95%CI 1.19;4.30) and pedestrians (IR=2.12; 95%CI 1.26;3.58) had an increased risk of death, while the risk of serious injuries was higher among motorcyclists (IR=2.38; 95%CI 2.01;2.83), cyclists (IR=2.35; 95%CI 1.76;3.13) and pedestrians (IR=2.83; 95%CI 2.27;3.53). **Conclusion**: the study revealed a number of deaths and serious injuries, closer to the real and identified vulnerable groups to plan traffic safety actions.

Keywords: Matched-Pair Analysis; Accidents; Mortality; Morbidity; Cross-Sectional Studies.

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Introduction

Road traffic accidents (RTA) are a serious problem of Public Health, with 1.2 million deaths worldwide in 2013, representing approximately 2.4% of the total number of deaths from all causes.[1,2]

In Brazil, from 2000 to 2012, the mortality rate per RTA increased from 17.6 to 22.1 deaths per 100 thousand inhabitants, representing an increase of 25.7%.[3] In 2012, the main fatal victims of RTA were motorcyclists, followed by occupants of cars, pedestrians and cyclists.[4] Approximately 80% of the total number of deaths by RTA occurred in males, with greater frequency in the age range of 20 to 39 years (45.7%).[1] In the same year 2012, there were 180,169 hospitalizations per RTA, representing an increase of 10.62% in relation to 2010.[5]

Goiânia showed a mortality rate per RTA de 30,3/100 thousand inhabitants in 2012, greater than Brazil in the same year. The main victims were males (78%) and aged 20 to 29 years (23%).[6] As the mode of transport in 2007, accidents involving motorcyclists accounted for 75% of the total number of traffic accidents, followed by cyclists, occupants of cars and pedestrians.[2]

> *Goiânia showed a mortality rate per RTA de 30,3/100 thousand inhabitants in 2012, greater than Brazil in the same year.*

As to the quality of the data from the Mortality Information System (SIM), from 2005, we observed an increase in the coverage and reduction of the percentage of ill-defined causes of death. However, in 2010, even if observed deaths with nonspecific codes that, in the case of RTA, could reach about 20%.[7,8]

In addition, the values of the indicators of morbidity and mortality by RTA may be higher, because there are not, in Brazil, an information system that integrates data bases of Health and the Transit with the objective to define the records unspecific. Such a situation makes it difficult to estimate the actual number of deaths and serious injuries resulting from RTA.[1,9] In order to overcome this limitation, a viable alternative and low cost is the realization of the relationship of databases of Health and the Transit with the aim of improving the quality of data, supplementary information and thus enable the planning of more effective actions for prevention and reduction of such accidents.[1,10]

This article had as objective to identify the magnitude and factors associated with death and serious injury among victims of RTA occurring in the urban area of Goiânia, Goiás State, Brazil.

Methods

A cross-sectional study for the identification of severe and fatal victims of RTA, occurring in the urban area of Goiânia in the months of January to June 2013.

In the year 2013, Goiânia, capital of the state of Goiás, had 1,393,575 inhabitants[11] and a fleet of 1,045,796 motor vehicles, in total, being 54% of automobiles and 19.8% of motorcycles.[12]

The databases were used data from the Mortality Information System (SIM) and the National Hospital Information System (SIH/SUS), in addition to the single list of victims (SLV), consists of the occurrences of RTA statements by the Department of Transit (Detran) and by records of Mobile Emergency Care Service (SAMU).

RTA are defined as external causes of accidental and are inserted in Chapter XX of the International Statistical Classification of Diseases and Related Health Problems Tenth Revision (ICD-10) is the basic cause of death per RTA codified as V01-V89.[13]

The outcomes analyzed in this study were: (I) seriously injured - every victim of RTA admitted in a hospital for at least 24 hours and the victim of RTA that has gone to death within 30 days after the accident; and (ii) death - all fatal victim of RTA whose death occurred in up to 30 days after the accident.

The explanatory variables considered in the analysis were:

- sex (male; female);
- age group (in years: 0-17, 18-29, 30-39, 40-49, 50-59 and 60 and over);
- mode of transportation (car, motorcycle, bicycle and pedestrian);
- condition of the victim (driver, passenger and pedestrian); and
- time of occurrence of the RTA (0:00-5:59 am, 6:00-11:59 am, 12:00-5:59 pm and 6:00-11:59 pm)

To facilitate the procedure of relationship of databases (linkage), the data cleansing and standardization of variables to be used in pairing.

Were performed three procedures of probabilistic record linkage: The first, between the data base of the Detran and SAMU, to obtain the single list of victims; the second, between the single list of victims and the base of the SIM data, for the identification of deaths whose occurred in up to 30 days; and the third, between the data base of the SIH/SUS and the single list of victims, for the identification of the number of serious injuries.

It was used the software RecLink III for the realization of the linkage.[10] Were defined the following variables in the block:

- Step 1 - soundex (phonetic algorithm) of first name + last name soundex + birth year + date of occurrence of the accident (SLV) / date of death (SIM) / date of hospitalization (SIH/SUS-SLV);
- Step 2 - soundex of first name + soudex of Last name + age + date of occurrence of the accident / date of death (SIM-SLV) / date of Hospitalization (SIH/SUS-SLV);
- Step 3 - soundex of first name (PBLOC) + date of occurrence of the accident / date of death (SIM-SLV) / date of hospitalization (SIH/SUS-SLV) + sex;
- Step 4 - soundex of first name + date of occurrence of the accident / date of death their books (SIM-SLV) / date of hospitalization (SIH/SUS-VIT); and
- Step 5 - soundex of first name + last name soundex

For the procedure of comparison, were defined the variables 'Name' (option-character) and 'date of birth' (option-character or difference among the dates). Were identified the likely true pairs and performed a manual review of the pairs and research at the Institute of Forensic Medicine (IML) for doubtful accounts.

The deaths or serious injuries of an accident occurred outside the urban perimeter of Goiânia were excluded.

Frequency tabulations of variables were conducted, to characterize the profile of victims of traffic accidents. The proportion of serious injuries (number of serious injuries per RTA/total number of victims of RTA) and deaths (number of deaths per RTA/total number of victims of RTA) were calculated per category of variables.

For the analysis of factors associated with the severity of the injury of accidents, were considered as outcome variables the deaths and serious injuries. The reasons of incidence and respective range of 95% confidence intervals and Z test were estimated, for statistical inference of comparison of effects among the categories of each variable, using the regression model bi and multivariate analysis. For both models was used Poisson regression with robust variance, based on the software STATA version 8.0. Initially, gross analysis was conducted and tested the possible interactions among variables. The insertion of variables in the multivariate model was performed taking as reference the model steepwise forward, with the gradual introduction of variables that obtained a level of significance with p less than or equal to 0.20 in the crude analysis. In the final model, remained statistically significant variables ($p<0.05$), as well as the sex variable', which has been identified as a confounding variable.

The project of the study respected the ethical principles in research involving humans, being approved by the Ethics Research Committee of Federal University of Goiás (UFG): Opinion Consubstantiated No. 64/2013 of 01/04/2013. The funding of the study was made on the basis of Universal Notice No. 05/2012 of the Foundation for the Support of Research of Goiás State (FAPEG).

Results

The database data from SIM, used in linkage, registered 18,826 deaths from all causes, being 1,005 (5.33%) per RTA. On the bank of the SIH/SUS, the total number of hospitalizations was 80,164, being 2,698 (3.36%) hospitalizations per RTA (Figure 1a and 1b).

In the bank of victims, the total number of victims per RTA was 9,795, of which 658 were only recorded in the database of the SAMU. Approximately 70% of the victims were male and 43.66% were aged between 18 to 29 years; 63.22% were motorcyclists, followed by occupants of cars (25.65%) and pedestrians (7.15%).

After the linkage between the databases of the SLV and SIM, the total number of true pairs was 138; besides these, were identified only 10 deaths recorded in the database of victims and 7 deaths recorded in SIM, totaling 155 deaths. Of this total, 71% were male. The proportion of deaths was 1.60% (95%CI 1.33;1.99) in males, similar to the female sex, of 1.52% (95%CI 1.14;2.03). There was a predominance of deaths in the age group of 18-29 years (27.40%) and 60 years and more

(19.86%), with the proportion of deaths of 1.03% (95%CI 0.76;1.40) and 7.12% (95%CI 5.00;10.05), respectively (Tables 1 and 2).

The main fatal victims were motorcyclists (46%), followed by the occupants of cars (23.33%) and pedestrians (22%). The largest proportion of deaths was observed between pedestrians (4.81%), followed by cyclists (3.40%) (Tables 1 and 2).

There was a regular distribution of the number of fatal victims among the days of the week. In relation to the time of occurrence of the accident, found a higher frequency of deaths between 6:00 pm and 11:59 pm, notwithstanding the higher rate of proportion of deaths were recorded between 0:00 and 5:59 am (3.09%) (Tables 1 and 2).

In the adjusted analysis, the main factors associated with the occurrence of death among the victims of RTA were: (I) the age ranges of 40-49 years (reason of incidence [laughs]=2.75; 95%CI 1.11;6.79), 50-59 years (RI=4.46; 95%CI 1.80;11.04) and 60 years and older (RI=7.69; 95%CI 3.15;18.78), in relation to the age of 0-39 years; (ii) rental (RI=2.26; 95%CI 1.19;4.30) and pedestrians (RI=2.12; 95%CI 1.26;3.58), in relation to the automobile and motorcycle; and (iii) occurrence of the accident between 0:00 to 5:59 am hours (RI=2.47; 95%CI 1.36;4.47), in comparison with time of the accident between 6:00 and 11:59 pm (Table 3).

The total number of serious injuries obtained after the linkage between SLV and SIH/SUS was 1,225. It was observed that 70% were male and 38.5% were from 18 to 29 years of age (Table 1). In relation to the proportion of serious injuries according to sex, there was similarity: 12.60% (95%CI 11.55;13.09) and 12.33% (95%CI 11.01;13.35), respectively for males and females (Table 2). The main mode of transport for victims of serious was the motorcycle (70.7%). The proportion of serious injuries according to the mode of transport presented higher for pedestrians (19.83%) (95%CI 17.01;22.97), followed of cyclists (14.66%) (95%CI 11.46;18.56), motorcyclists (13.98%) (95%CI 13.13;14.88) and occupants of vehicles (6.5%) (95%CI 5.59;7.54) (Table 2). The condition of driver was the predominant (76.3%) (Table 1). On the day of the week, concentration was not observed in any particular day ; however, the Sunday showed the greatest proportion of serious injuries: 14.02% (95%CI 12.21;16.06). According to the zone, the largest proportion of serious injuries mentioned occurrences between 0:00 and 5:59 am: 15.93% CI(95% 12.84;19.59) (Table 2).

The variables associated with severe cases were: (I) according to age range, 40-49 years (RI=1.62; 95%CI 1.26;2.08), 50-59 years (RI=1.48; 95%CI 1.23;2.16) and 60 years and older (RI=2.00; 95%CI 1.50;2.66), in relation to the age of 0-39 years; (ii) a motorcycle (RI=2.38; 95%CI 2.01;2.83), rental (RI=2.35; 95%CI 1.76;3.13) and pedestrian (RI=2.83; 95%CI 2.27;3.53), in relation to the car; and (iii) occurrence of the accident in the period 0:00 to 5:59 am (RI=1.38; 95%CI 1.10;1.73), in comparison with time of the accident between 6:00 and 11:59 pm. (Table 4).

The Figure 1a and 1b show, respectively, the contributions of the linkage to the improvement of information on deaths and serious injuries. After linkage between SLV and SIM, the percentage of correction of the underlying cause of death was 43.87%, with alteration of the underlying cause for 68 deaths. Which in 46 deaths there was a change of ICD-10 V89 for RTA specified in 5 deaths there was an alteration of other groups of causes for the specified group of RTA (ICD-10 V01-V88), and to 7 deaths there was a change of the underlying cause within the group of RTA (V01-V88). In 10 deaths that had only record in the database of victims, the cause of death was defined on the basis of the Bulletin of Occurrence (BO) of traffic accident and investigation in IML. For the database of victims, the linkage identified 15 deaths are not classified as such on the basis of traffic data, corresponding to a percentage of 9.67% of correct classification of the severity of the injuries suffered by the victim (Figure 1a).

After the linkage between SLV and SIH/SUS, the percentage of correction of the secondary diagnosis of hospitalization was 51.34%, with amendment of the code for 629 hospitalizations. There were changes in the degree of severity of the lesions of the victims of traffic accidents for the bank of Detran, after the linkage between SLV and SIH/SUS: 647 wounded people were not serious to serious, after the linkage, corresponding to a percentage of 52.81% of correct classification of the degree of severity of the lesion (Figure 1b).

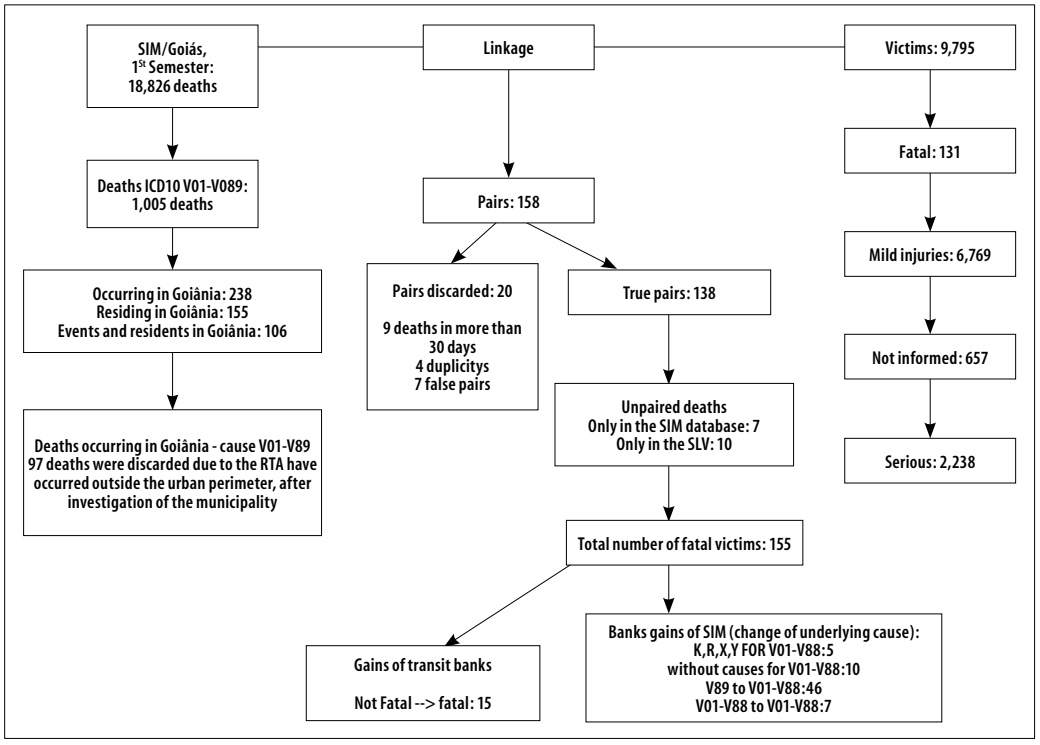

Figure 1a – Flow diagram of linkage procedure between the database of the victims of traffic accidents (SLV) and the Mortality Information System on (SIM), Goiânia, January-June, 2013

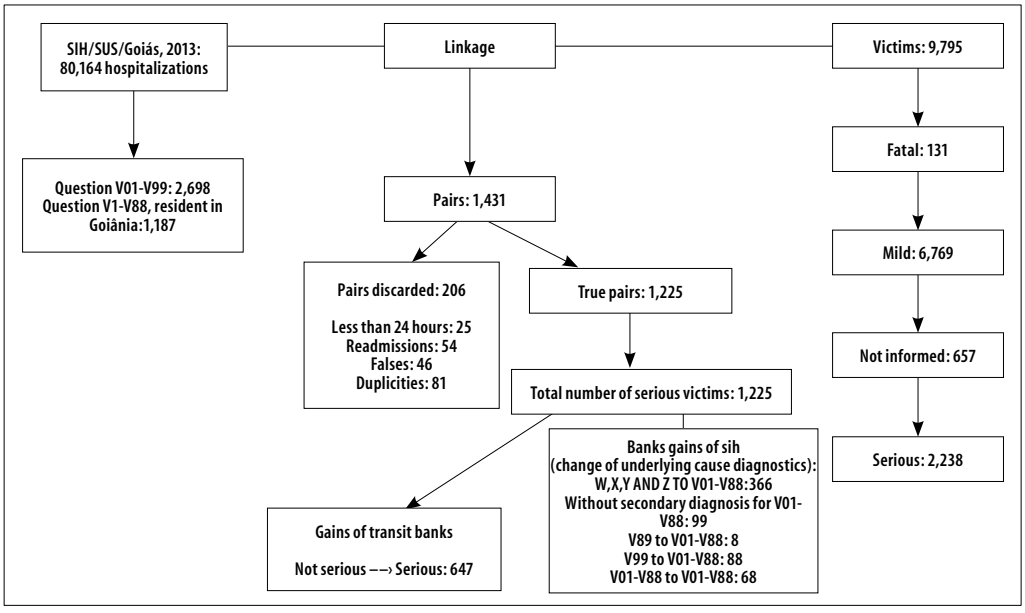

Figure 1b – Flow diagram of linkage procedure between the database of the victims of traffic accidents (SLV) and the Mortality Information System on (SIH/SIM), Goiânia, January-June, 2013

Table 1 – Distribution of total victims, serious injuries and deaths per accident de terrestrial transport, according to sex, age range, transportation modal, condition of the victim, day of the week of occurrence of the accident and time of the accident, Goiânia, january-june, 2013

Variables	Total victims				Serious injuries				Deaths			
	N[a]	%	95%CI[b]		N[a]	%	95%CI[b]		N[a]	%	95%CI[b]	
			LL[c]	UL[d]			LL[c]	UL[d]			LL[c]	UL[d]
Sex[e]												
Female	2,952	30.16	29.26	31.08	364	29.71	27.22	32.33	45	29.03	22.46	36.62
Male	6,835	69.84	68.92	70.74	861	70.28	67.67	72.78	110	70.97	63.38	77.54
Age group (in years)												
0-17	711	8.03	7.48	8.62	77	6.33	5.05	7.70	6	4.11	1.78	8.18
18-29	3,863	43.66	42.64	44.71	468	38.51	35.52	40.96	40	27.40	19.56	33.22
30-39	2,091	23.63	22.76	24.53	286	23.53	21.06	25.80	25	17.12	11.17	22.73
40-49	1,186	13.40	12.71	14.13	200	16.46	14.36	18.50	23	15.75	10.11	21.28
50-59	588	6.64	6.14	7.18	101	8.31	6.83	9.91	23	15.75	10.11	21.28
≥60	407	4.64	4.18	5.05	83	6.83	5.49	8.36	29	19.86	13.35	25.58
Transportation Modal[g]												
Car	2,460	25.65	24.78	26.53	160	13.33	11.29	15.06	35	23.33	16.71	29.78
Motorcycle	6,064	63.22	62.25	64.18	848	70.66	66.58	71.75	69	46.00	36.92	52.38
Bicycle	382	3.98	3.62	4.39	56	4.66	3.53	5.89	13	8.67	4.96	13.82
Pedestrian	686	7.15	6.65	7.68	136	11.33	9.46	12.98	33	22.00	15.58	28.39
The victim's condition[h]												
Driver	7,026	74.1	73.14	74.9	904	76.28	71.26	76.18	92	60.92	52.97	68.35
Passenger	1,769	18.1	17.87	19.43	145	12.23	10.15	13.77	26	17.21	12.03	24.03
Pedestrian	686	7.23	6.72	7.76	136	11.47	9.46	12.98	33	21.85	16.01	29.10
Day of the week the accident[i]												
Sunday	1,248	12.74	12.10	13.42	175	14.30	12.44	16.36	25	16.34	11.17	22.73
Monday	1,440	14.70	14.02	15.42	156	12.75	10.98	14.72	23	15.03	10.10	21.28
Tuesday	1,299	13.26	12.61	13.95	147	12.01	10.30	13.94	21	13.73	9.03	19.82
Wednesday	1,333	13.61	12.95	14.31	169	13.81	11.98	15.94	19	12.42	7.99	18.35
Thursday	1,452	14.83	14.14	15.54	196	16.02	14.05	18.16	22	14.38	9.56	20.55
Friday	1,482	15.13	14.44	15.86	188	15.37	13.44	17.47	22	14.38	9.56	20.55
Saturday	1,539	15.72	15.01	16.45	192	15.69	13.75	17.82	21	13.73	9.03	19.82
Time of the accident[j]												
0:00 to 5:59 am	452	4.68	4.27	5.12	72	6.03	4.69	7.33	14	9.59	5.45	14.59
6:00 to 11:59 am	2,967	30.72	29.81	31.65	315	26.40	23.35	28.23	42	28.77	20.72	34.58
12:00 to 5:59 pm	3,391	35.11	34.16	36.07	411	34.45	30.96	36.24	41	28.08	20.14	33.93
6:00 to 11:59 pm	2,848	29.49	28.59	30.41	395	33.10	29.69	34.91	49	33.56	24.81	39.31

a) N: number of cases.
b) 95%CI: 95% confidence interval.
c) LL: lower limit.
d) UL: upper limit.
e) 8 victims without sex informed.
f) 949 victims without age informed.
g) 203 victims without transportation modal informed.
h) 335 victims without condition of victim informed.
i) 2 victims without a day of the week the accident informed.
j) 137 victims without time of the accident informed.

Table 2 – Proportion of serious injuries and deaths, according to sex, age range, transportation modal, victims condition, day of the week of occurrence of the accident and time of the accident, Goiânia, January-June, 2013

Variables	Victims	Proportion of serious injuries				Proportion of deaths			
	N[a]	N[a]	%	95%CI[b]		N[a]	%	95%CI[b]	
				LL[c]	UL[c]			LL[c]	UL[c]
Sex[e]									
Female	2,952	364	12.33	11.01	13.35	45	1.52	1.14	2.03
Male	6,835	861	12.60	11.55	13.09	110	1.60	1.33	1.93
Age group (in years)									
0-17	711	77	10.83	8.75	13.33	6	0.84	0.39	1.83
18-29	3,863	468	12.11	11.12	13.19	40	1.03	0.76	1.40
30-39	2,091	286	13.68	12.27	15.22	25	1.19	0.81	1.76
40-49	1,186	200	16.86	14.84	19.10	23	1.93	1.29	2.89
50-59	588	101	17.18	14.34	20.44	23	3.91	2.62	5.80
≥60	407	83	20.39	16.76	24.58	29	7.12	5.00	10.05
Transportation Modal[g]									
Car	2,460	160	6.50	5.59	7.54	35	1.42	1.02	1.97
Motorcycle	6,064	848	13.98	13.13	14.88	69	1.13	0.90	1.43
Bicycle	382	56	14.66	11.46	18.56	13	3.40	1.99	5.73
Pedestrian	686	136	19.83	17.01	22.97	33	4.81	3.44	6.68
The victim's condition[h]									
Driver	7,026	904	12.87	12.10	13.67	92	1.31	1.06	1.60
Passenger	1,769	145	8.20	7.00	9.56	26	1.47	1.00	2.14
Pedestrian	686	136	19.83	17.01	22.97	33	4.81	3.44	6.27
Day of the week the accident[i]									
Sunday	1,248	175	14.02	12.21	16.06	25	2.00	1.36	2.94
Monday	1,440	156	10.83	9.33	12.54	23	1.59	1.06	2.38
Tuesday	1,299	147	11.32	9.70	13.15	21	1.61	1.06	2.45
Wednesday	1,333	169	12.68	11.00	14.57	19	1.42	0.91	2.21
Thursday	1,452	196	13.50	11.84	15.35	22	1.51	1.00	2.28
Friday	1,482	188	12.69	11.09	14.48	22	1.48	0.98	2.23
Saturday	1,539	192	12.48	10.92	14.22	21	1.36	0.89	2.07
Time of the accident[j]									
0:00 to 5:59 am	452	72	15.93	12.84	19.59	14	3.09	1.85	5.13
6:00 to 11:59 am	2,967	315	10.62	9.55	11.78	42	1.41	1.04	1.90
12:00 to 5:59 pm	3,391	411	12.12	11.06	13.26	41	1.20	0.89	1.63
6:00 to 11:59 pm	2,848	395	13.87	12.65	15.19	49	1.72	1.30	2.26

a) N: number of cases.
b) 95%CI: 95% confidence interval.
c) LL: lower limit.
d) UL: upper limit.
e) 8 victims without sex informed.
f) 949 victims without age informed.
g) 203 victims without transportation modal informed.
h) 335 victims without condition of victim informed.
i) 2 victims without a day of the week the accident informed.
j) 137 victims without time of the accident informed.

Table 3 – Reasons of incidence, confidence intervals and p-value of deaths per road transport accident (RTA), according to sex, age range, transportation modal and time of the accident, by means of Poisson regression with robust variance, crude and adjusted analysis, Goiânia, January-June, 2013

Variables	Crude Analysis				Adjusted analysis			
	IR[a]	95%CI[b]		P value[c]	IR[a]	95%CI[b]		P value[c]
		LL[d]	UL[and]			LL[d]	UL[and]	
Sex								
Female[f]								
Male	1.05	0.74	1.48	0.757	1.07	0.75	1.55	0.690
Age group (in years)								
0-17								
18-29	1.22	0.52	2.88	0.639	1.42	0.60	3.35	0.420
30-39	1.41	0.58	3.43	0.441	1.55	0.62	3.82	0.340
40-49	2.29	0.94	5.61	0.068	2.75	1.11	6.79	0.030
50-59	4.63	1.89	11.30	0.001	4.46	1.80	11.04	0.001
≥60	8.44	3.53	20.16	0.000	7.69	3.15	18.78	0.000
Transportation Modal								
Car[f]								
Motorcycle	0.19	0.53	1.19	0.278	0.99	0.65	1.50	0.960
Bicycle	2.39	1.27	4.47	0.006	2.26	1.19	4.30	0.010
Pedestrian	3.38	2.11	5.39	0.000	2.12	1.26	3.58	0.005
Time of the accident								
12:00 to 5:59 am	1.80	1.00	3.23	0.049	2.47	1.36	4.47	0.003
6:00 to 11:59 am	0.82	0.54	1.23	0.350	0.77	0.51	1.18	0.230
12:00 to 5:59 pm	0.70	0.46	1.06	0.093	0.71	0.46	1.08	0.110
6:00 to 23:59 pm[f]								

a) IR: incidence ratio.
b) 95%CI: 95% confidence interval.
c) p: Probability of significance by means of Poisson regression.
d) LL: lower limit.
e) UL: upper limit.
f) Reference category of each variable.

Discussion

The methodological procedures adopted in the study identified a number, nearest to the real, of fatal victims and severe in the municipality of Goiânia, during the first half of 2013. This study showed the improvement of the coding of underlying cause of death in SIM and the secondary diagnosis of hospitalization in SIH/SUS. Were also identified serious and fatal victims who were not classified as such in the bank of victims of traffic.

Among the victims of RTA in Goiânia, we observed a higher frequency of males, aged between 18 and 29 years and of motorcyclists, both for the death outcome '' and 'seriously injured '. The factors associated with the occurrence of injuries caused by traffic accidents were: age greater than 40 years; time of accident between 0:00 and 5:59h, for the outcomes "death' and ' seriously injured ; cyclists and pedestrians, for 'death' and 'seriously injured ', as well as for people injured in general; and cyclists, for the outcome 'seriously injured '.

A study dating from 2012-2013 found similar results for five capitals of Brazil researched. Approximately 80% of deaths in Belo Horizonte and Curitiba, 85% in Teresina and Campo Grande and 65% in Palmas were male; about serious injuries, approached 80% in Belo Horizonte and Teresina and 77% in Campo Grande and Palmas were male, also.[14] Another study carried out in Nepal in 2004, showed that the higher

Table 4 – Reasons of incidence, confidence intervals and p-value of deaths per road transport accident (RTA), according to sex, age range, transportation modal and time of the accident, by means of Poisson regression with robust variance, crude and adjusted analysis, Goiânia, January-June, 2013

Variables	Crude analysis				Adjusted analysis			
	IR	95%CI[b]		P value[c]	IR	95%CI[b]		P value[c]
		LL[d]	UL[and]			LL[d]	UL[e]	
Sex								
Female[f]								
Male	1.02	0.91	1.14	0.715	0.99	0.89	1.11	0.970
Age group (in years)								
0-17								
18-29	1.11	0.89	1.40	0.334	1.07	0.84	1.35	0.570
30-39	1.26	0.99	1.60	0.053	1.21	0.94	1.54	0.120
40-49	1.55	1.21	1.99	0.000	1.62	1.26	2.08	0.000
50-59	1.58	1.20	2.08	0.001	1.48	1.23	2.16	0.001
≥60	1.88	1.41	2.50	0.000	2.00	1.50	2.66	0.000
Modal transportation								
Car[f]								
Motorcycle	2.16	1.83	2.54	0.000	2.38	2.01	2.83	0.000
Bicycle	2.26	1.70	3.01	0.000	2.35	1.76	3.13	0.000
Pedestrian	3.06	2.47	3.79	0.000	2.83	2.27	3.53	0.000
Time of the accident								
12:00 to 5:59 am	1.14	0.91	1.44	0.239	1.38	1.10	1.73	0.005
6:00 to 11:59 am	0.76	0.66	0.87	0.000	072	0.63	0.83	0.000
12:00 to 17:59 pm	0.87	0.76	0.99	0.040	0.84	0.73	0.95	0.008
6:00 to 23:59 pm[f]								

a) IR: incidence ratio.
b) 95%CI: 95% Confidence Interval.
c) p: probability of significance by means of Poisson regression.
d) LL: Lower limit.
e) UL: Upper limit.
f) Reference category of each variable.

frequency of male victims can be attributed to the fact that men assume a more aggressive behavior in traffic and expose themselves more in urban roads.[15]

Regarding age range, the highest frequency of deaths and serious injuries observed in young people can be so explained: this is the cycle of life with higher activity and, therefore, greater tendency to take risks as drinking and driving, print excess speed to the vehicle, do not use of safety belts, and driving at night.[15,16] the town and about Brazilian capitals above (2012-2013) found in Campo Grande, a result similar to this work: 44% of deaths and 48% of serious injuries per RTA in the capital of Mato-Grosso do Sul referred to the age range from 18 to 29 years.[14]

With respect to the factors associated to the severity and occurrence of deaths, this study showed a dose-response gradient in relation to the variable "age groups". For both serious and fatal victims, we observed higher reasons of incidence at the age greater than or equal to 60 years, in relation to the others. This can be explained by the fact that elderly patients have a greater probability of presenting a limitation in motor functional capacity and the presence of comorbidities, able to aggravate the health framework after a traffic accident. These people may also have difficulty in understanding the dynamics of traffic, possibly aggravated by deficiencies in signalling, absence of pedestrian

strip and time of green signal insufficient for a safe crossing of the elderly.[17] A study conducted in Italy, in the period 1991-1996, there has been a ten times greater risk of fatal injuries in individuals older than 65 years, in relation to minors of 30 years of age.[18]

On the mode of transport, the higher frequency of both deaths and serious injuries was observed for the accidents whose victims were motorcyclists. In Thailand, in 2009, 74% of traffic accidents involved motorcyclists.[9] In Brazil, studies conducted in 2013 and 2015 have showed a similar reality , giving motorcycles an impeller factor of violence in current days.[19]

The increase in the frequency of accidents involving motorcyclists may be explained by the sharp increase in the rate of motorization for motorcycles from 2008, in the country. The fact is associated with the ease of credit to purchase this type of vehicle, to increase the income of the population and the low quality of collective public transport in most Brazilian cities.[20]

Other factors that may be associated to traffic accidents involving motorcyclists are risk behaviors adopted by them, as for example, the passage between vehicles in adjacent rows, in addition to the occupational risks inherent in the precarious labor ties common among users of motorcyclists.[19] Since the worsening of injuries suffered in this type of accident can be explained by the high vulnerability of the type of vehicle, greater exposure index of the motorcyclist, as well as neglect or improper use of the recommended safety equipment.[17.20]

Cyclists had higher risk of serious injury and death in relation to other modes of transport. A similar result was already observed in a study of 2007-2008, in France, where he showed a risk of death 1.5 times greater for cyclists in relation to occupants of automobile.[21] This situation shows a greater vulnerability and multiple trauma by the absence of any protection (in addition to a helmet, in the case of a small proportion of cyclists), worsening the health situation of the victim.[21]

In relation to the period when the accident occurred, this study showed that between 0:00 and 5:59 am, the risk of presenting a serious injury was significantly greater. Such a situation may be related to the fact that tracks are more free at this time and, consequently, the possibility of displacement with higher average speed, less supervision and, especially, driving under the influence of alcohol.[22.23] previous study, carried out in Italy in 2002, obtained similar results with greater risk of death in accidents occurring from 1:00 to 5:00 am, in relation to accidents between 6:00 and 11:00 am.[18]

In relation to the quality of the data, we observed differences in the numbers of deaths and serious injuries, according to the different data bases. A study conducted in Belo Horizonte, in the period 2008-2010, noted difficulty of measuring the actual number of deaths and serious injuries based on sources of information that record the RTA in isolation.[24]

For the victims of traffic - SLV -, there was an increase of 18% in the number of deaths after linkage between banks SLV and SIM, coincides with the results of a previous study performed in Italy in 2000, when there was an increase of 21% of deaths in relation to the official records of the police after linkage.[25] In another study, this time in Mali, after the linkage, the mortality rate was two times greater when compared to the rate calculated using only data from the police.[26] The present study observed changes in the coding of underlying cause of death in SIM, whose ICD-10 code was changed to other groups of cause for the group of deaths per RTA. This change reaffirms what has been described in previous studies, about problems in the classification of external causes in the database SIM - in which are described the lesions and not the circumstances that generated -, underestimating the statistics of mortality by external causes.[27.28]

In relation to the serious injuries, the SLV, there was a greater number of serious victims (52%), in relation to the result after the linkage, because such classification is carried out by agents of transit, without the application of standardized criteria of definition of gravity and without information from the follow-up of victims after the accident.

After the linkage between SLV and SIH/SUS, there was a correction of classification of victims, increasing in 60% the number of serious injuries in the database of the victims of traffic. A previous study, conducted in Portugal in the period 2006-2011, noted an increase of 29% of serious injuries to the database of police, after the linkage with the hospital database.[29]

It is reasonable to consider that the relationship between the data bases was essential for the identification of cases recorded only in a data source in the correct classification of the severity of the lesion,

in the correction of the underlying cause of death in SIM and the secondary diagnosis of hospitalization in SIH/SUS.

In addition, the linkage incorporated a greater quantity of variables which potentiate the data analysis - variables related to the characteristics of the accident, the vehicle and the conditions of the tracks -, allowing to identify risk factors and local under higher risk of occurrence of accidents, that can guide traffic safety interventions directed to the prevention and reduction of RTA, as well as reducing the degree of severity of the lesions. A study in 2012 says that the quality and accuracy of the data directly influence the planning of actions and in the prioritization of traffic safety while political decisions.[30]

A limitation of this study was to use secondary records, with variables not informed although considered essential for the understanding of the accident. Such a situation was minimized by the relationship of data bases. A methodological concern the highlight is the thorough manual verification of pairs found, both for the deaths and serious injuries, with the aim of avoiding duplication or errors and inconsistencies during the linkage and analysis of data.

The findings of this study suggest the importance of traffic accidents in the city of Goiania. The higher frequency of the victims of such accidents, they are fatal or serious injury, converges with the national reality.

In relation to the quality of the data, the integration of databases of health and traffic allowed the identification of problems in the completion of the records and a better understanding of the terrestrial transport accidents - RTA-, as a consequence of the increase in the coverage of information about these accidents.

Authors' contributions

Mandacarú PMP contributed to the conception and design of the study, data analysis and drafting of the article. Rabelo IVM, Silva MAA and Tobias CG contributed to the conception and design of the study, acquisition and analysis of data and preliminary drafting of article. De Morais Neto OL contributed to the conception and design of the study, data analysis, drafting and critical revision of the article. Both authors approved the final version to be published and are responsible for all aspects of the study, ensuring its accuracy and integrity.

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