

## A STATISTICAL STUDY OF TRAFFIC ACCIDENTS IN THE CITY OF LONDRINA-PR IN 2019

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- **ABSTRACT:** This article addressed traffic accidents in the urban perimeter of the city of Londrina-Paraná, Brazil, carried out in 2019. The information used was from the Integrated Emergency Trauma Care System and collected through the General Occurrence Registry (RGO) of the Fire Department of Londrina. For this study, accidents were selected in the collision category between vehicle drivers and motorized drivers. The study variables were the most frequent months and the accident codes defined by Integrated Trauma Emergency Service (SIATE). The article aimed to analyze the occurrences (collision) of vehicle drivers in 2019, seeking to make the population aware of accident prevention. The methodology adopted was descriptive, quantitative, obtained intentionally. The results show that these categories of drivers are responsible for more than 50% of the total accidents and more than 60% of the fatal victims. According to the results obtained, it is expected that the authorities may be sensitized, adopting measures that lead those responsible to more rigorous sanctions, thus making drivers aware of having greater responsibility when driving a vehicle, emphasizing that they need to redouble their attention and have responsibility in traffic, avoiding negligence and damage to the lives of others.
- **KEYWORDS:** Traffic accidents; official statistics; risk behavior.

### 1 Introduction

Unsafe attitudes in traffic, such as speeding, ingestion of alcoholic beverages, risky maneuvers and lack of attention from drivers lead the ranking of the main causes with traffic accidents.

According to the National Traffic Department (DENATRAN, 2011), the number of victims of traffic accidents is very high. One way to decrease this number of traffic accidents is through the awareness of young people. This work aims to analyze the

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occurrences (collision) of motor vehicle drivers and thus raise awareness of accident prevention.

The number of accidents and fatalities increases every year, with higher death rates among young drivers. When we analyze the cases of victims in traffic, we can see the large number of young people involved in this type of violence, according to the World Health Organization (2015).

According to Waiselfisz (2011), the numbers presented by World Health Organization (WHO) are terrifying. In the year of 2009, close to 1,3 million deaths from traffic accidents in happened 178 countries in the world. With the increase in the vehicles' fleet and with the recklessness in traffic, WHO estimates that we should have 1,9 million traffic deaths in 2020 and 2,4 million in 2030.

About the fleet increase, Oliveira *et al.* (2018), considers that the car fleet has grown substantially, as it is an efficient transport for the population of higher income levels. In this regard, we can cite the large number of young people who, at the age of 18, already own their own car.

The Código de Trânsito Brasileiro (CTB) completed 22 years on September 23, 2019. Instituted by Lei Federal nº. 9,503/1997, the CTB has 341 articles and 688 resolutions (BRASIL, 1997). Even though it is considered good legislation by several specialists, it has not yet been possible to take Brazil out of a shameful position in the world ranking of traffic deaths: fifth place, after India, China, the United States and Russia (WAISELFISZ, 2011).

According to Mello Jorge (1980), in these cases, the government spends a significant amount in public health to maintain and treat these victims, since many of these accidents could be avoided, not encumbering the public coffers. Therefore, raising awareness can be an arduous and time-consuming process but necessary when trying to preserve the lives of our fellow citizens.

Raising drivers' awareness about the rules of respect for traffic was done at a time when the number of vehicles grew absurdly and, as a result, traffic became more complex, thus increasing the number of occurrences.

According to Silva (2019), in view of the data pointed out by who, it becomes more evident that it is not enough just to invest in traffic engineering, road improvement or even the creation of inspection and control systems such as "Prohibition" laws or speed radars. It is necessary to constantly invest in the process of traffic education and this investment should happen from a very early stage by the family and school, thus promoting a safety policy for all.

Thus, a question arose, what has been done to reduce this expressive number of victims?

For this questioning, we follow the guidelines of the Traffic Code that aims to educate drivers to the obedience of its articles. The drivers know that non-obedience lead to fines and administrative sanctions, however, the punishment alone is not enough, it is necessary to develop the drivers' critical sense, especially the young, because despite having knowledge of the traffic rules they insist on disrespecting them for a lack of reflection on the consequences.

It is worth mentioning that by following the traffic rules, we are taking care of people's integrity and safety. It is necessary to assess how harmful to society the trauma experienced by those involved in traffic accidents is.

### The Transit and its Regulations

According to Arrudão (1996), traffic is the movement of people or things along the roads.

Rozestraten (1988) defines traffic as a set of movements of people and vehicles on public roads, within a conventional system of standards that aims to ensure the integrity of its participants.

According to the Transit Code established in 1997, "traffic is considered the use of roads by people, vehicles and animals, alone or in groups, driven or not, for circulation, stopping, parking and loading or unloading operations".

The law 9,503 of September 23, 1997 has 341 items that provide instruments and conditions for the process of circulation of goods and people within the physical space to develop in safety standards with efficiency and fluidity. This code was created to reach an entire Brazilian population, not just the driver.

The Brazilian Traffic Code provides a clear division of responsibilities and a solid partnership between federal, state and municipal agencies. The municipalities, in particular, have had their sphere of competence substantially expanded in dealing with traffic issues. In fact, it is no longer fair to consider that in the municipality, where the citizen actually lives, works and moves around.

Once integrated into the National Transit System, the municipality begins to assume responsibility for planning, designing, operating and inspecting, not only in the urban perimeter, but also on municipal roads. The municipalities that are part of this integration into the National Transit System will now perform signaling, inspection, penalty enforcement and traffic education tasks.

## 2 Traffic accidents

Data from the World Health Organization inform that traffic is the most complex and the highest risk for individuals in a population.

A traffic accident is an unintentional disagreement, which implies some damage and is notified to the police. Disagreement can be any unexpected event that interrupts normal activity.

Rozestraten (1988), "an unintentional disagreement, involving one or more traffic participants, implying some damage and notified to the police directly or through the services of Legal Medicine".

The accident defined by the World Health Organization is an event independent of man's desire, caused by an external force that suddenly acts and leaves wounds in the body and mind (GOLD, 1998).

Traffic Accident is an unintentional event, which occurs on public roads with at least one traffic system user, and which causes material and personal damages to those involved (SIMÕES et al, 2001).

Abdetran (2001) completes the concept of traffic accidents as all harmful events, involving the vehicle, the road, man and/or animals.

The factors related to the track are the responsibility of traffic engineering, which seeks to identify possible problems related to its geometry, signaling, regulation and use of the track, paving and existing traffic flow. Regarding the environment, it is of

fundamental importance to identify the weather conditions and visibility at the time of traffic accidents, and beyond the aspects of land use and occupation (FERRAZ *et al.*, 1999).

The vehicle factor is related to safety equipment, engine power, stability and vehicle maintenance and conservation conditions, such as tires, brakes and engine (MARCHESINI, 2006).

### 3 Methodology

For this study, we considered the traffic occurrences within the geographical limit of the municipality of Londrina, from January 1<sup>st</sup> to December 31<sup>st</sup>, 2019. In this period, 4,305 occurrences were attended by SIATE, however, for this study, we selected a sample of 2,677 accidents, the choice of the sample was due to the fact that the researchers chose for the analysis the category "collision" between motor vehicles.

At the first moment, the researchers selected the research data at the General Registry of Occurrences (RGO) of the Fire Department of Londrina municipality. In the register it was possible to identify some categories of accidents such as: collision against bulkheads, fall of vehicles, running over, roll-over, drawing-in and leaving the track.

The months that most accidents occurred were verified in the survey and, within this category, the number of deaths and injured victims were verified and they were classified through the injury code (SIATE standard).

The months of attendance were grouped according to the calendar, and the victim's injury code (SIATE standard) was defined as: unharmed, code 1 (minor injuries), code 2 (injuries considered serious without risk to life), code 3 (injuries considered serious with risk to life) and code 4 (death).

The information is presented by types of accidents, that is, auto versus auto (AxA), auto versus motorcycle (AxM), motorcycle versus motorcycle (MxM), auto versus bicycle (AxB), auto versus truck (AxC), auto versus bus (AxO) and motorcycle versus bicycle (MxB) as shown in the following table.

Table 1 - Statistics of Traffic Accidents in the Year 2019

Accidents in means of transportation													
Occurrence/ Collision	Months												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
A x A	47	33	48	31	40	51	41	35	57	34	43	36	496
A x M	105	133	146	158	144	151	135	168	154	129	145	124	1,692
M x M	37	23	32	20	26	18	20	17	21	29	21	21	285
A x B	5	2	7	5	5	3	8	8	5	7	5	6	66
A x C	5	-	2	9	9	11	-	1	9	1	7	4	59
A x O	-	4	1	-	13	1	-	4	5	2	1	2	33
M x B	4	6	4	3	2	8	2	2	5	3	5	2	46
TOTAL	203	201	240	226	239	243	206	235	256	205	227	195	2,677

Source: General Registry of Events (RGO) of the Londrina City Fire Department, 2019

#### 4 Results and discussions

This section presents and discusses the results of accidents that occurred with automobiles, motorcycles, trucks, buses and bicycles registered in the Bulletins of Occurrence (BO) and the Integrated Service of Assistance to Trauma and Emergencies (SIATE), in the city of Londrina, Brazil.

The months of January to December 2019 were analyzed, as shown in the table below, noting that in the results obtained, from January to December, it was possible to verify that in a total of 2,677 accidents involving collisions between motor vehicles, the highest incidence was between auto versus motorcycle, being the smallest number of accidents in the month of January and the largest in the month of August, as shown in the results of the descriptive statistics analysis below. A descriptive statistical analysis points results in the following table:

Table 2 - Descriptive analysis of accident data in the various categories in 2019

Statistics	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Minimum	-	-	1	-	2	1	-	1	5	1	1	2
Maximum	105	133	146	158	144	151	135	168	154	129	145	124
Median	5	6	7	9	13	11	8	8	9	7	7	6
First quartile (25%)	4.5	3	3	4	7	5.5	1	3	5	2.5	5	3
Third quartile (75%)	42	28	40	25.5	33	34.5	30.5	26	39	31.5	32	28.5
Interquartile Deviation	37.5	25	37	21.5	26	29	29.5	23	34	29	27	25.5
Arithmetic Mean	29	28.7	34.3	32.3	34.1	34.7	29.4	33.6	36.6	29.3	32.4	27.9

Source: General Registry of Events (RGO) of the Londrina City Fire Department, 2019.

The statistical analysis showed that the coefficient of variation in the months is very low, the peak months were April and August and the month of lowest incidence was January.

Figure 1 shows that the month with the highest number of traffic accident victims was August, with 9.9%, and that the month of January was the one with the lowest incidence of accidents, 6.2%.

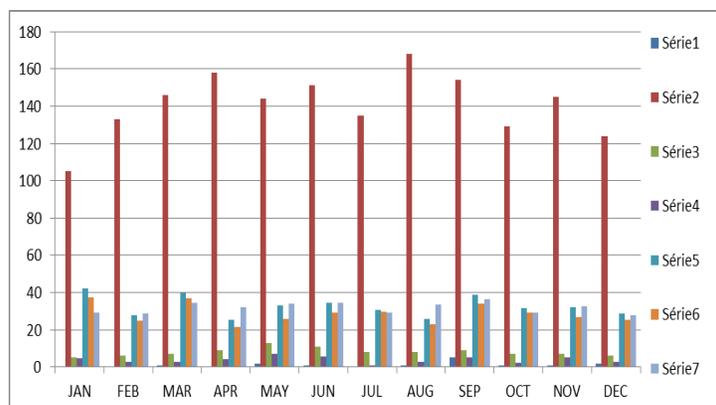


Figure 1 - Monthly descriptive statistical measures 2019 (Source: General Registry of Events (RGO) of the Londrina City Fire Department, 2019).

We can observe by the time series graphic that the months with the lowest accidents occur in the months of January and December (6.2% and 7.3%) respectively and the months with the highest numbers of accidents were: April, (9.3%), September (9.1%) and, August with (9.9%) this fact is due to the fact that many companies grant vacations to their employees at the end and beginning of the year, decreasing the flow of loads on the roads considerably in the months of April, August and September with the closings of the quarters there is a greater flow of product deliveries by companies in the industrial sector. In general, there are no major variations between the months throughout the year, with a considerable number of accidents every month.

A descriptive analysis showed that the maximum number of accidents was in August with 168 accidents and a minimum value in January with 105 accidents, the arithmetic mean was around 144.5, accidents and the months in the upper quadrant are with cutoff values approximately 151.75 accidents, while the lower quartile is cut at 132.0

The data collection also showed that the number of deaths due to accidents was higher when cars and motorcycles were involved, because motorcycles offer little safety to drivers at the time of an accident. It was reported that the number was variable throughout the months of January to December, in the year 2019, with minimum values of 89 and maximum of 168 and a median of 144.5 accidents.

Looking at both Chart 1 and the graph, it can be seen that the number of victims involving cars and motorcycles in the months of January to December shows a significant difference in their values  $p < 0.05$ , which can be seen and verified through a Chi-square test, as shown in the following results when applying this test to data involving accidents between cars and motorcycles.

Table 3 - Accidents involving Auto and Motorcycles in 2019

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Obs. F.	105	133	146	158	144	151	135	168	154	129	145	124
Exp.F	141	141	141	141	141	141	141	141	141	141	141	141

Source: General Registry of Events (RGO) of the Londrina City Fire Department, 2019

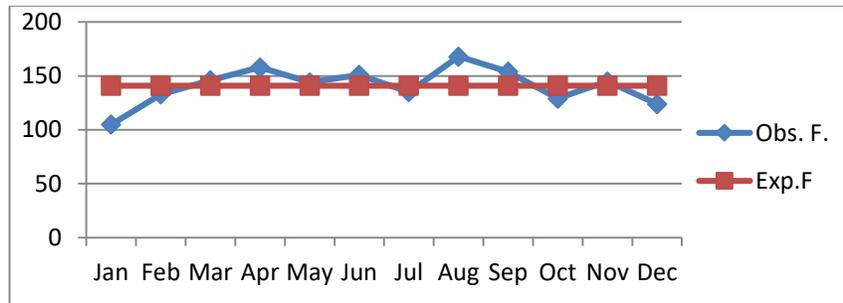


Figure 2 - Data variability in relation to accident averages 2019 (Source: General Registry of Events (RGO) of the Londrina City Fire Department, 2019).

Graph 2 shows that the accident data in the year 2019 has a random trend behavior in relation to the average, but its variability is small compared to the values of the maximum and minimum intervals obtained.

## 5 SIATE injury code

In our research, we used the occurrences database provided by this service, whose function is to attend the victims on site and, if there is a need, refer them to hospitals in the city, if there is no need, the victim can be released at the site of the accident. It was found that the number of deaths (code 4) is relatively small compared to other types of accidents as shown in Table 4.

Table 4 - State of victims (according to the SIATE injury code) of Accidents

Types of occurrence	STATE OF VICTIMS					Total number of victims
	unharmed	Code 1	Code 2	Code 3	Code 4	
A x A	65	321	103	5	1	495
A x M	19	998	600	73	3	1,693
M x M	2	177	99	6	1	285
A x B	3	40	18	5	--	66
A x C	3	30	14	2	9	58
A x O	1	19	10	2	1	33
M x B	--	25	19	2	--	46
<b>TOTAL</b>	<b>93</b>	<b>1610</b>	<b>863</b>	<b>95</b>	<b>15</b>	<b>2,676</b>

Source: General Registry of Occurrences (RGO) of the Londrina City Fire Department, 2019.

According to the victim's condition, we have code 1 (minor injuries), code 2 (injuries considered serious without risk to life), code 3 (injuries considered serious with risk to life) and code 4 (death).

According to the SIATE injury code, during the year 2019, it was possible to verify that the highest incidence of victims was between auto versus motorcycle, totaling 1,693 victims out of 2,676 victims.

According to the descriptive statistical analysis, as shown in Table 5, it was shown that there is great variability among the codes with very high coefficients of variation, being them: Code 1 considered minor injuries followed by code 2 considered serious without risk of life, however they presented higher incidences.

Table 5 - Descriptive statistics Table according to the SIATE injury code

Statistics	Unharmed	Code 1	Code 2	Code 3	Code 4
Minimum	-	19.00	10.00	2.00	-
Maximum	65.00	998.00	600.00	73.00	40.00
Median	3.00	36.50	33.50	5.00	1.00
First quartile (25%)	1.75	28.75	17.00	2.00	0.75
Third quartile (75%)	26.00	213.00	100.00	12.25	4.50
Arithmetic Mean	17.50	205.38	113.88	15.75	6.87
Standard Deviation	24.98	337.54	199.98	25.08	13.70
Coefficient of Variation	1.42	1.64	1.75	1.59	1.99

Source: General Registry of Occurrences (RGO) of the Londrina City Fire Department, 2019

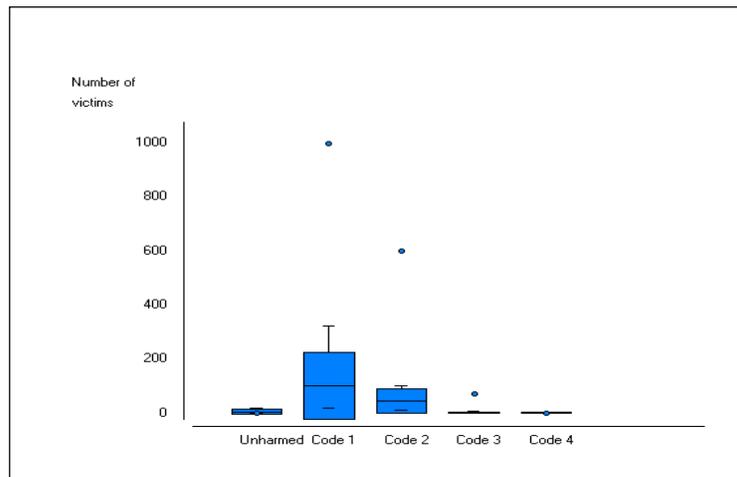


Figure 3 - Victims' states (according to SIATE's injury code) (Source: General Registry of Occurrences (RGO) of the Londrina City Fire Department, 2019).

The Boxplot chart of SIATE codes only confirmed the great variability that exists in the number of services, which once again makes the occurrence of Code 1 and Code 2 noticeable.

## Conclusion

Although belonging to all categories, accidents were predominantly between car and motorcycle. Besides these factors, some authors also attribute greater exposure of males to factors that act as coadjuvants to automobile accidents, such as alcohol consumption and more aggressive behavior. (BARCHIFONTAINE, 1992).

As for the characteristics of accidents in the year 2019 that generated 4,305 occurrences, involving 2,677 victims in the subcategories auto versus auto, auto versus motorcycle, motorcycle versus bicycle, auto versus truck, auto versus bus and motorcycle versus bicycle, this study shows that the highest frequency in accidents was between auto versus motorcycle. It is deduced that the motorcycle is prevalent because it is a cheaper vehicle and the fastest mean of transportation, ending up being more accessible for the general population (MELLO JORGE, 1980).

In view of the results presented in this work, it is worth pointing out that in relation to the Brazilian Traffic Code, in effect since 1998, there was a very optimistic hope of reversing the national and municipal traffic accidents. However, the greatest impact was immediately after its implementation, with a marked reduction in the number of accidents and victims (AMATUZZI *et al.*, 1998; BASTOS *et al.*, 1999; TAHA, 2001).

Due to these reasons, the City Hall of Londrina and the Secretary of Traffic are increasingly committed to changing this situation, implementing actions that prioritize education - in educational lectures, in media advertising to directly reach the drivers, in the urban road system - engineering intervention to improve as much as possible the network of the road system of Londrina (deploying traffic circle, breakwaters, traffic lights); and a broad fiscalization of behavior in traffic - which encompasses legislation and policing with impositions of fines, because these actions are indispensable to reach a safe and organized traffic.

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- *RESUMO: Este artigo abordou os acidentes de trânsito no perímetro urbano da cidade de Londrina-Paraná, Brasil, ocorridos em 2019. As informações utilizadas foram do Sistema Integrado de Atendimento ao Traumatismo e coletadas no Cadastro Geral de Ocorrências (RGO) do Corpo de Bombeiros de Londrina. Para este estudo, os acidentes foram selecionados na categoria colisão entre condutores de veículos e motoristas. As variáveis de estudo foram os meses mais frequentes e os códigos de acidentes definidos pelo Serviço Integrado de Emergência em Trauma (SIATE). O artigo teve como objetivo analisar as ocorrências (colisões) de condutores de veículos em 2019, buscando conscientizar a população para a prevenção de acidentes. A*

metodologia adotada foi descritiva, quantitativa, obtida de forma intencional. Os resultados mostram que essas categorias de motoristas são responsáveis por mais de 50% do total de acidentes e mais de 60% das vítimas fatais. De acordo com os resultados obtidos, espera-se que as autoridades sejam sensibilizadas, adotando medidas que levem os responsáveis a sanções mais rigorosas, conscientizando os motoristas de maior responsabilidade na condução do veículo, ressaltando que precisam redobrar a atenção e ter responsabilidade no trânsito, evitando negligências e danos à vida de terceiros.

- PALAVRAS-CHAVE: Acidentes de trânsito; estatística oficial; comportamento de risco.

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