Changes in the profile of victims of land transport accidents in Brazil from 2010 to 2020

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1 INTRODUCTION

During the decade from 2010 to 2020 there were several changes in traffic-related situations in Brazil that changed the trend in mortality from land transport accidents (ATT), according to the ICD10 classification, or from *traffic accidents*, according to ABNT nomenclature. The upward trend that had been observed since the year 2000 changed to a downward trend starting in 2014. (FERREIRA et al., 2022)

Over these ten years, more than 380 thousand people have died from land transport accidents in Brazil, which shows that this is a serious social problem and a public health problem.

The retrospective evaluation of mortality trends can indicate situations or policies that should be strengthened or avoided in order to achieve the goals of the Second Decade of Actions for Traffic Safety or the National Plan for the Reduction of Traffic Deaths and Accidents (PNATRANS), which have the goal of reducing traffic fatalities by 50%.

2 OBJECTIVE

Describe the change in the profile of victims of transportation accidents in Brazil from 2010 to 2020, with respect to gender and age group.

3 METHODOLOGY

Initially, a survey was conducted of policies, initiatives, and programs on Traffic Safety that began to be implemented in Brazil between 2010 and 2020.

Next, the data of deaths by Land Transport Accidents (ATT) in the Mortality Information System of the Ministry of Health, ICD10 codes V01 to V89, were analyzed, comparing the totals of 2020 with those of 2010. Weighting was done with respect to the population of each sex or age group in this period.

To calculate the rates per 100,000 inhabitants, for sex the data from Preliminary Estimates prepared by the Ministry of Health/SVSA/DAENT/CGIAE were used and for age the calculations from Resident Population - Study of Population Estimates by Municipality, Age and Sex 2000-2021 - Brazil, from IBGE, both available on Tabnet/Datasus.

4 PREVENTION INITIATIVES IMPLEMENTED BETWEEN 2010 AND 2020

In this period, several initiatives were implemented at the international, national, state or local levels to prevent traffic accidents. The most prominent are: a) the World Decade; b) the *Road Safety in Ten Countries* program; c) the National Plan for the Reduction of Accidents and Road Safety; d) changes in Brazilian traffic legislation; e) the National Plan for the Reduction of Traffic Deaths and Injuries (PNATRANS); (FERREIRA et al. 2022) and f) changes in the automobile and educational market.

The first Decade involved the World Health Organization (WHO), which conducted several studies, published manuals and technical texts, developed materials for prevention campaigns, organized three Global Ministerial Conferences with dozens of heads of state and other regional events, and numerous actions that were carried out to encourage the implementation of traffic accident prevention policies (UN, 2020).

The *Road Safety in Ten Countries* program, known in Brazil as Vida no Trânsito program, was one of the initiatives derived from the Global Decade. According to the Ministry of Health, this program follows the guidelines of the Local Action Plan and the Decade Plan 2011-2021. The national activities are structured in five pillars: 1. road safety management; 2. safe roads; 3. safe vehicles; 4. legislation and user behavior; and 5. Trauma Care, Prehospital Care, and Rehabilitation (WHO, 2018). The World Health Organization (WHO) encouraged and monitored the implementation of these actions in the ten countries with the highest number of traffic deaths, in partnership with universities, foundations, and national and local organizations. In Brazil, it was supported by GRSP, Bloomberg and the Pan American Health Organization (PAHO), with the participation of several ministries and entities of the National Traffic System (SNT) (SILVA, 2013). It was initially implemented in five capital cities, one in each region, and later extended to the other capital cities and cities with more than one million inhabitants, besides Foz do Iguaçu. As of 2018, it was open to the participation of any municipality in the country, but a few months later, the Ministry of Health revoked all ordinances related to this program and there is still no definition for the future of this program.

In 2011, the federal government, through the National Mobilization Committee for Health, Safety and Peace in Traffic, prepared the National Plan for the Reduction of Accidents and Road Safety, mobilizing institutions of the SNT, other related entities and civil society for the creation of a set of measures aimed at reducing mortality rates and injuries by traffic accidents in the country, through the

implementation of actions related to enforcement, education, health, infrastructure and vehicle safety; in the short, medium and long term. The Plan did not receive a final wording, therefore it was not implemented. However, it presented actions that eventually came to be implemented by some managing agencies, such as: a) expand the electronic control of speed and advancement of traffic lights; b) expand the control of drunk drivers, respect for pedestrian crosswalks, motorcycles, use of helmet and seat belt, cell phone, child carriage and overtaking; c) standardize and disseminate best practices through the media. (BRASIL, 2010).

Over the decade (2011-2020), several changes occurred in the Brazilian traffic legislation through decrees, bills, resolutions, ordinances and other instruments. Despite criticism from experts, it is possible to identify some changes consistent with the policies promoted by the WHO to prevent injuries from traffic accidents, such as mandatory airbags and ABS brakes in cars; CBS or ABS brakes on motorcycles; legislation that prohibits driving under the influence of alcohol (known as Dry Law) and regulates the alcohol test; as well as electronic control of speed, traffic lights and other infractions. There was also the implementation of previously proposed measures, for example, there was the national integration of vehicle and driver registers, which facilitated the inspection of vehicles and the penalization of drivers outside their state of origin, and the increased use of electronic speed control, especially in capital cities and cities with more than 100,000 inhabitants. However, there were also changes in the legislation that left loopholes for the increase of situations that contribute to the occurrence of accidents, such as the increase of points for suspension of the driver's license, difficulties in speed control, and restrictions in the inspection of the working hours of truck drivers.

The 2011 National Plan for Reducing Traffic Accidents and Safety was not implemented, but it was not forgotten, through Federal Law No. 13,614, January 11, 2018, the National Plan for Reducing Traffic Deaths and Accidents (PNATRANS) was created, which allowed the proposal to be resumed. It established that the Federal Highway Police (PRF) and the State Traffic Councils (CETRAN), in partnership with the other managing bodies, must prepare annual Action Plans and monitor reduction targets. PNATRANS is composed of 6 pillars, which consolidate the set of actions and responsibilities to be taken on, they are Pillar 1: Traffic Safety Management; Pillar 2: Safe Routes; Pillar 3: Vehicle Safety; Pillar 4: Traffic Education; Pillar 5: Victim Care; Pillar 6: Standardization and Enforcement. One of the factors that contributed to the lack of effectiveness of PNATRANS was the inexistence of a Management Committee (FERNANDES, 2020).

The impacts evaluated in this study are a consequence of the policies implemented in this period, as well as of the changes in Brazilian society that may have stimulated both the reduction and the increase in accidents. For example, the dissemination of the use of car seats for transporting children and the offer in the automobile market of a greater number of models with assistive technologies for driving vehicles, such as: rear sensors, rearview cameras, dynamic stability and

traction control, asymmetric and anti-glare headlights, seat belt alarm not fastened, ramp start aid, DRL (Daytime Running Light) lighting system, and side airbags.

Another change observed in Brazilian society was the increase in the number of post-graduate courses associated with the theme of road safety (traffic law, traffic engineering, mobility management, traffic education, etc), as well as the number of scientific events (Congresses, Seminars, Meetings...).

5 DATA ANALYSIS

The actions cited were aimed at reducing the number of deaths, the number and severity of injuries, and the number of traffic accidents.

This study evaluated the number of ATT deaths registered in the Mortality Information System (SIM) of the Ministry of Health, according to the ICD10 classification.

Table 1 - Deaths from land transport accidents and by sex in Brazil, 2010 and 2020

Sex	Deaths		
	2010	2020	2020/2010 (%)
Male	34.941	27.489	-21,33
Female	7.889	5.211	-33,95
Unidentified	14	16	
Total	**42.844**	**32.716**	**-23,64**

Source: Mortality Information System of the Brazilian National Health System (SIM/SUS)

During this decade, there was a 23.6% reduction in the number of deaths from ATT in Brazil, and for females, the reduction was 33.9%, higher than the 21.3% reduction for males.

The PRF had identified a reduction in male participation among deaths on federal highways, from 82.11% in 2011 to 81.702% in 2020, which was not confirmed among the total number of deaths in Brazil, where men were 81.55% in 2021 and became 84.02% of the total in 2020. (BRAZIL, 2021)

Table 2 - Population by sex in Brazil, 2010 and 2020

Sex	Population		
	2010	2020	2020/2010 (%)
Male	95.513.268	103.527.641	8,39
Female	99.377.414	108.228.051	8,91
Total	**194.890.682**	**211.755.692**	**8,65**

Source: Preliminary estimates prepared by the Ministry of Health/SVSA/DAENT/CGIAE

During this period the Brazilian population grew by 8.65%, according to estimates by the Ministry of Health, and there was a greater increase in females than males.

Table 3 - Land transport accident mortality rate and by sex per 100,000 inhabitants in Brazil, 2010 and 2020

Sex	Rate per 100,000 inhabitants		
	2010	2020	2020/2010 (%)
Male	36,58	26,55	-27,42
Female	7,94	4,81	-39,35
Total	**21,98**	**15,45**	**-29,72**

With this, the difference between the ATT mortality rates for females and males (39.4% and 27.4%, respectively) was greater than the difference between the absolute values.

The same type of evaluation was performed by age groups, as can be seen below.

Table 4 - Deaths from land transport accidents and by age group in Brazil, 2010 and 2020

Age Group	Deaths		
	2010	2020	2020/2010 (%)
Less than 1 year	121	65	-46,3
1 to 4 years	436	234	-46,3
5 to 9 years old	559	251	-55,1
10 to 14 years old	779	386	-50,4
15 to 19 years old	3.411	2.208	-35,3
20 to 29 years old	11.277	7.476	-33,7
30 to 39 years old	8.303	6.681	-19,5
40 to 49 years old	6.454	5.496	-14,8
50 to 59 years old	4.855	4.592	-5,4
60 to 69 years old	3.191	2.972	-6,9
70 to 79 years old	2.143	1.510	-29,5
80 years and older	1.007	691	-31,4
Ignored age	308	154	-50,0
Total	**42.844**	**32.716**	**-23,6**

Source: Mortality Information System of the Brazilian National Health System (SIM/SUS)

In this decade there was a reduction in the absolute values of mortality from ATT in all age groups, but the reduction was more pronounced for those under 29 and for those aged 70 and over.

When evaluating the evolution of the population, it can be seen that there was an 8.7% increase in the total population, but with an increase in the population aged 30 or more and a reduction in the population aged 1 to 29.

Table 5 - Population by age group in Brazil, 2010 and 2020

Age Group	Population		
	2010	2020	2020/2010 (%)
Less than 1 year	2.906.821	2.943.139	1,25
1 to 4 years	11.951.475	11.787.161	-1,37
5 to 9 years old	15.865.210	14.650.284	-7,66
10 to 14 years old	17.397.298	14.805.480	-14,90
15 to 19 years old	17.219.079	15.790.890	-8,29
20 to 29 years old	34.810.915	34.219.132	-1,70
30 to 39 years old	30.031.077	34.231.979	13,99
40 to 49 years old	25.176.600	29.255.503	16,20
50 to 59 years old	18.664.323	23.875.072	27,92
60 to 69 years old	11.502.710	16.732.965	45,47
70 to 79 years old	6.390.018	9.023.041	41,21
80 years and older	2.975.156	4.441.046	49,27
Total	**194.890.682**	**211.755.692**	**8,7**

Source: Preliminary estimates prepared by the Ministry of Health/SVSA/DAENT/CGIAE

Table 6 - Road transport mortality rate and by age group per 100 thousand inhabitants in Brazil, 2010 and 2020

Age Group	Rate per 100,000 inhabitants		
	2010	2020	2020/2010 (%)
Less than 1 year	4,16	2,21	-46,9
1 to 4 years	3,65	1,99	-45,6
5 to 9 years old	3,52	1,71	-51,4
10 to 14 years old	4,48	2,61	-41,8
15 to 19 years old	19,81	13,98	-29,4
20 to 29 years old	32,40	21,85	-32,6
30 to 39 years old	27,65	19,52	-29,4
40 to 49 years old	25,63	18,79	-26,7
50 to 59 years old	26,01	19,23	-26,1
60 to 69 years old	27,74	17,76	-36,0
70 to 79 years old	33,54	16,73	-50,1
80 years and older	33,85	15,56	-54,0
Total	21,98	15,45	-29,7

Analyzing the ATT mortality rates per 100,000 inhabitants, an average reduction of 29.7% is observed, and that the main reductions were for the elderly aged 70 years or more and for children aged zero to 14 years. The reduction was smaller precisely for the age groups with the highest number of displacements, those between 15 and 69 years old.

Table 7 - Deaths from land transport accidents and by mode of transport in Brazil, 2010 and 2020

Transport Mode	Deaths		
	2010	2020	2020/2010 (%)
Motorcycle	10825	11853	+9,50
Car	9401	6987	-25,68
On foot	9944	5120	-48,51
Bicycle	1513	1352	-10,64
Truck	780	751	-3,72
Bus	160	111	-30,63
Other ATT	10221	6542	-35,99
Total	**42.844**	**32.716**	**-23,6**

Source: Mortality Information System of the Brazilian National Health System (SIM/SUS)

There was a large reduction in the number of deaths from pedestrian collisions (48.51%) on a reduction in total deaths of 23.6%. The reduction in deaths of car and pickup truck occupants was slightly greater than that of overall mortality (25.68%). In the opposite direction, there was a 9.50% increase in motorcyclist deaths.

In a general view it can be seen that during the first decade, the stimuli to reduce road traffic deaths in Brazil were more effective for the groups up to 30 years old. And less effective for the 15 to 69 age groups.

There has also been an increase in longevity and the exposure of the elderly to the risks of being involved in traffic accidents.

The data analyzed do not allow us to evaluate an initiative, a policy, or an action, because the reduction, or not, of mortality is a consequence of the set of changes that occurred in this period. Even, some actions may not be "governmental policies", but changes in society.

6 CONCLUDING REMARKS

In this decade there was a profusion of initiatives in search of mortality reduction, however, there was no political articulation that would allow a consistent and sustainable implementation of the initiatives. Thus, there was a big difference between the measures effectively implemented in each state or city.

During the decade from 2010 to 2020 there was a reduction in the number of deaths from land transport accidents in Brazil for both sexes and for all age groups. However, this reduction was not homogeneous.

A reduction in the number of deaths was observed for both sexes. The ATT mortality rate for females was reduced by 39.4%, and for males, by 27.4%.

In this period there was a reduction in the absolute values of ATT mortality in all age groups, but the reduction was more pronounced for those under 29 years old and those 70 years old and older. Simultaneously there was a reduction in the younger population and an increase in the older population. With this, we observed a reduction of more than 50% in the ATT mortality rate per 100,000 inhabitants for the elderly aged 70 years or older and more than 40% for the population up to 14 years old.

These groups (children and young people, the elderly, and women) have a greater share in walking and public transport, where there has been a greater reduction in mortality, while adults and men have a greater share in motorcycle transport, where there has been an increase in mortality.

The implemented actions generated a more effective result in the female population than in the male population. They were also more effective with the elderly aged 70 and older and with young people.

The decrease in pedestrian fatalities (48.51%) was more intense than for users of the other modes of transportation. Motorcyclists were the only group in which there was an increase in the number of deaths.

The differentiated reduction by gender and age group seems associated with the reduction by mode of transportation.

There is no indication that there was any intentionality on the part of the managers to benefit these groups.

Although there has been an increase in the movement of elderly people in Brazilian society, this has come with an increase in road safety for this social group.

The changes carried out involved actions in all the PNATRANS Pillars: Traffic Safety Management; Safe Routes; Vehicle Safety; Traffic Education; Victim Care; Standardization and Enforcement.

Due to the importance of this topic, it is suggested that further studies be carried out to evaluate:

- Whether the educational actions had a preferential targeting to these publics;
- Whether these audiences are more susceptible to educational campaigns;
- The relationship between the reduction in deaths of children and adolescents and the implementation of traffic education programs in schools;
- The real impact and return on investment of educational campaigns;
- The reduction of pedestrian crashes on urban roads and rural roads;
- How these differences in mortality reduction play out across the country's regions and federal units;
- the reduction in mortality in companies that have safety at work strongly established as a culture;

Traffic education campaigns are constantly being elaborated and disseminated in the media, social networks, spread along the highways, however, there is a lack of an investigative perspective to approach the tangibility and assertiveness of these campaigns for each gender or age group.

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